GPS Measurements for SIR-C/X-SAR and TOPSAR Forest Test Stands at Raco, Michigan Site

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1. Purpose

This report presents the GPS measurement of ground level at SIR-C/X-SAR and TOPSAR forest test stands. In order to extract the trees' height information from images of SIR-C/X-SAR and TOPSAR, the ground level of each stands should be measured in high accuracy. To fulfill this purpose, differential GPS measurement has been done in May 18 - 24,1997.

At the same time, in order to create the Interferometric SAR(=IFSAR) images, the location of Ground Control Points(=GCPs) is needed in high accuracy for registeration of two images. To fulfill this purpose, differential GPS measurement has been done.

2. Methodology

2-1. Differential GPS

24 GPS satellites orbit the earth twice per day. GPS receivers on the ground calculate their positions by making distance measurement to four or more satellites.

If two GPS receivers are located within several miles and one of the their locations is the point whose coordinates are already known in high accuracy, differential GPS is applied for higher accurate measurement.

Figure 1 shows the concept of differential GPS. The GPS receiver A(known point) transmits the information of calculated location to GPS receiver B(unknown point) through radio link. This enables the GPS receiver B to calculate its own location in high accuracy. To calculate the location in high accuracy, the following things are required.

(a) The location of known point(GPS receiver A) should be known in high accuracy in advance.

(b) GPS receiver B analyzes the time it takes for radio signal to travel from GPS receiver A to GPS receiver B. So the farther the distance is, the more chances of multipath will occur. To avoid the multipath, the distance between the two GPS receivers should be within several miles.

To satisfy the condition (a), NGS data sheets of Benchmark are used in this measurement.(See Appendix E)

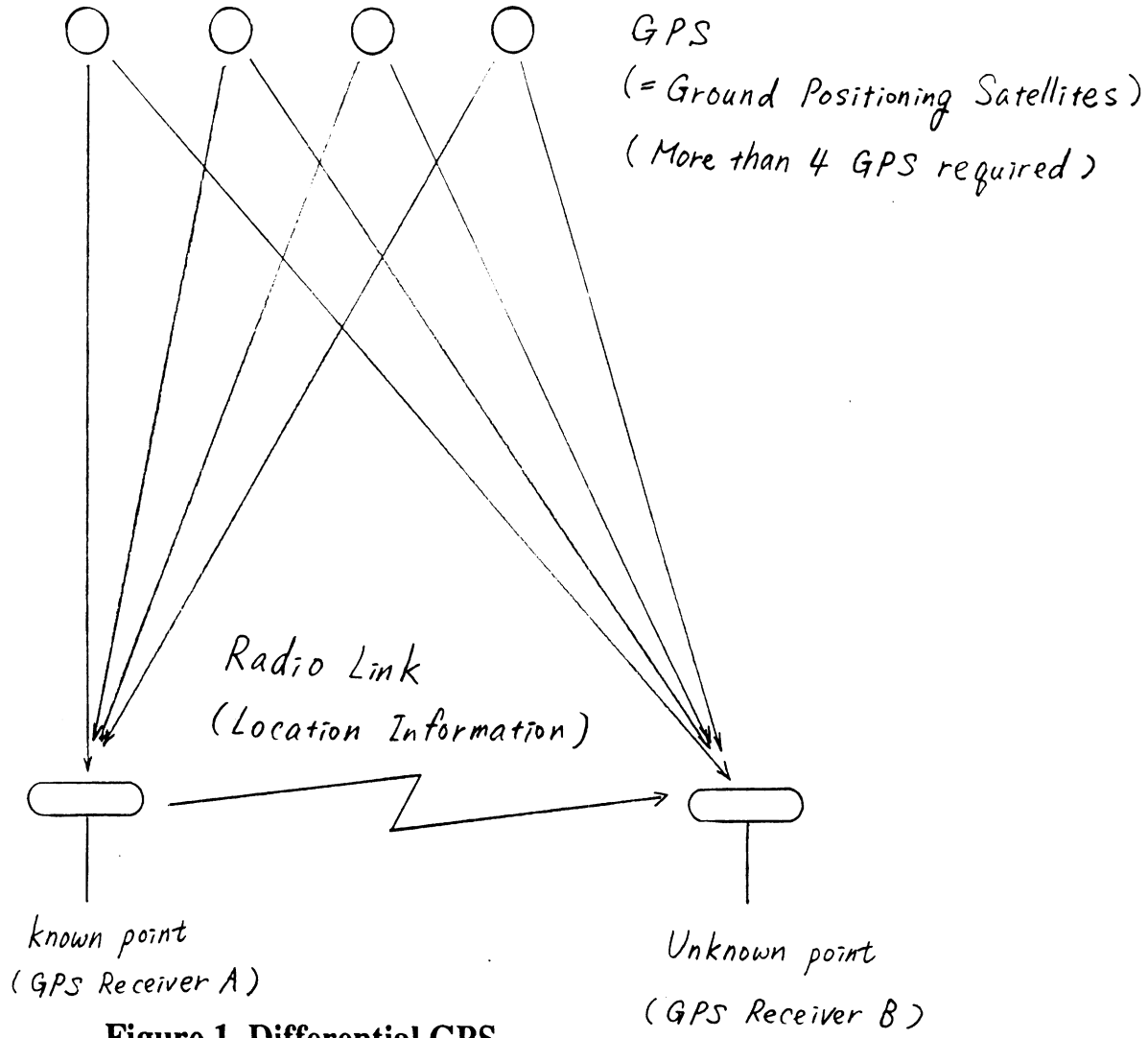

Figure 1 Differential GPS

2-2. Application to Forest Environments

To apply differential GPS to forest environments, 10-meter pole is used.

If the GPS antenna is installed at the top of the pole, GPS signal will be received even in the high forests. Figure 2 shows the installation.

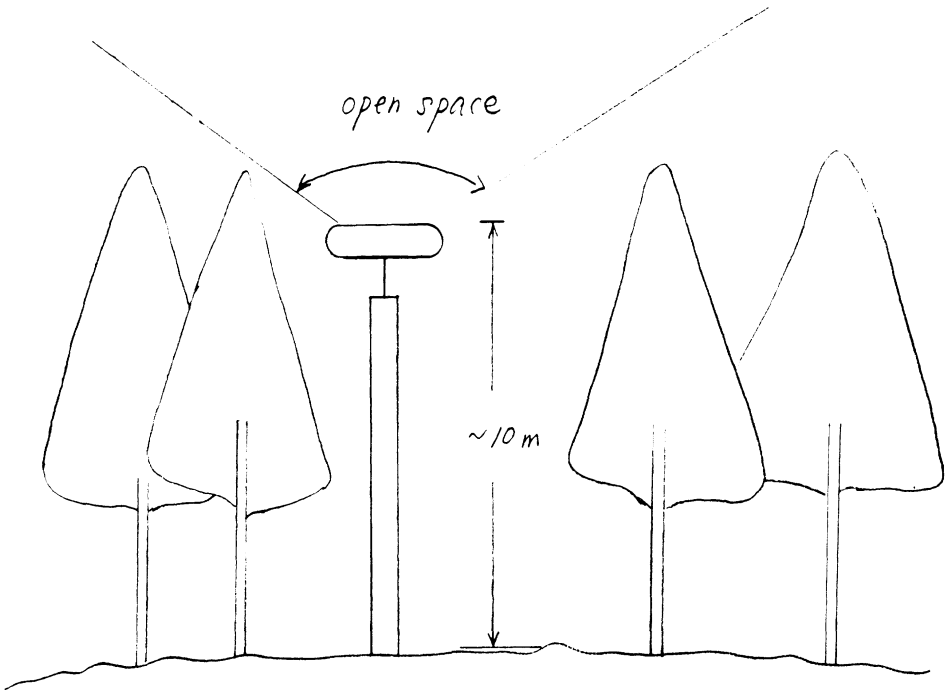

Figure 2 10-meter pole and GPS antenna

3. Equipment

Table 1 shows the equipment which were used in the measurement and its accuracy.

Table 1 Equipment used in the measurement

GPS Receiver	"Site Surveyor SSi 4000" [Trimble Navigation Co.]
Horizontal accuracy	+_(1cm +2ppm) +_(0.03ft.+2ppm*baseline length)
Vertical accuracy	+_(2cm +2ppm) +_(0.07ft.+2ppm*baseline length)

If the radio link is established, the calculation of location is done in realtime.This measurement is called "Realtime Kinematic(=RTK) mode".

In case that the radio link is unable to be established, postprocessing is possible by running the software at the personal computer. This measurement is called "Postprocess infill(=PP infill) mode".

4. Results

Table 2 shows the results of the measurement. The detail results are shown in the appendices.

Table 2 The results of the measurement

Number of measured stands	23
Number of points in measured stands	408
Number of locations of Ground Control Points(=GCPs)	29

Appendix A: Daily Log

Table A-1 shows the daily record. The measurement was done by two rovers(groups). The detail data record is shown afterwards.
All the data are expressed on WGS coordinate.
Including the cover sheet, **appendix A** is totally 20 pages.

Table A-1 GPS measurement daily record (1 of 2)

Day	Rover 1	Rover 2
May 18 (Sun)	[Leland,Dennis,Taeyeoul,Yutaka] **GCP in Rudyard area** 1000-1016(PP infill) valid points: 5 invalid points: 2	
May 19 (Mon)	[Leland,Yutaka] **Stand 67** 1001-1040(PP infill) valid points: 40 invalid points: 0	[Dennis,Taeyeoul] **Stand 22** 2002-2007(RTK) valid points: 5 invalid points: 1
May 20 (Tue)	[Leland,Dennis] **GCP in Raco area** **R14,R15,R16,R17,R8** 1000-1005(RTK) valid points: 6 invalid points: 0 **Stand 59** 1006-1045(RTK) valid points: 40 invalid points: 0 **Stand 56** 1047-1085(RTK) valid points: 39 invalid points: 0	[Taeyeoul,Yutaka] **GCP in Mc Nearney Lake area** **R22** 1000-1005(PP infill) valid points: 6 invalid points: 0 **Stand 58** 1009-1029(RTK) valid points: 21 invalid points: 0
May 21 (Wed)	[Leland,Dennis,Yi-Cheng] **GCP in Raco area** **R9???** 1000(RTK) valid points: 1 invalid points: 0 **Stand 54** 1001-1043(RTK) valid points: 43 invalid points: 0 **Stand 38** 1044-1085(RTK) valid points: 42 invalid points: 0 **Stand 80** 1086-1101(RTK) valid points: 16 invalid points: 0	[Kamal,Taeyeoul,Yutaka] **Stand 61** 2000-2012(RTK) valid points: 13 invalid points: 0 **Stand 68** 2014-2032(RTK) valid points: 19 invalid points: 0

RTK: Data are acquired by realtime kinematic mode.
PP infill: Data are acquired by postprocess infill mode

Table A-1 GPS measurement daily record (2 of 2)

Day	Rover 1	Rover 2
May 22 (Thu)	[Dennis,Yi-Cheng] **GCP in Raco area** **R8** 1000,1001(RTK) valid points: 2 invalid points: 0 **Stand 66** 1002-1029(RTK) valid points: 28 invalid points: 0 **Stand 55** 1030-1046(RTK) valid points: 17 invalid points: 0 **Stand 69** 1047-1053(PP infill) valid points: 3 invalid points: 4	[Kamal,Taeyeoul,Yutaka] **Stand 71** 2001-2012(RTK) valid points: 12 invalid points: 0 **Stand 72** 2013-2024(RTK) valid points: 12 invalid points: 0 **Stand 40** 2025-2039(RTK) valid points: 15 invalid points: 0 **GCP in Raco area** **R18,R19,R20** 2040-2064(PP infill) valid points: 25 invalid points: 15
May 23 (Fri)	[Dennis,Yi-Cheng] **Stand 45** 1000-1016(PP infill) valid points: 17 invalid points: 0 **Stand 34** 1017-1022(PP infill) valid points: 4 invalid points: 2	[Kamal,Taeyeoul,Yutaka] **Stand 31** 2000-2003(PP infill) valid points: 4 invalid points: 0 **Stand 49** 2004-2026(PP infill) valid points: 22 invalid points: 1
May 24 (Sat)	[Dennis,Yi-Cheng] **Stand 33** 1000-1006(RTK) valid points: 7 invalid points: 0 **Stand 85** 1007(PP infill) valid points: 1 invalid points: 0 **GCP in RACO area** **R18,R19,R20,R31** 1008-1019(PP infill) valid points: 12 invalid points: 0 **GCP in Rudyard area** **R33,R34** 1020-1027(RTK) valid points: 6 invalid points: 2	[Kamal,Taeyeoul,Yutaka] **Stand 50** 2000-2007(RTK) valid points: 8 invalid points: 0 **GCP in Mc Nearney Lake area** 2008-2018(PP infill) valid points: 10 invalid points: 1 **GCP in RACO area** 2019-2025(RTK) valid points: 7 invalid points: 0

RTK: Data are acquired by realtime kinematic mode.
PP infill: Data are acquired by postprocess infill mode

GCP measurement
May 18(Sunday) Rudyard area Day #1

The data are WGS coordinate.
Base Station
Pnt # Latitude Longitude Height Code
3001,46.1872884000,-84.5622481306,204.000,RJ1102 BM "RJ1102"

/*================= Rover No.1 ====================================*/
No RTK mode measurement was done.

PP infill mode
Pnt # Latitude Longitude Height Code
1000,46.1870756889,-84.5716812758,203.182,R5-1 GCP "R5" No.1
1001,46.1871502019,-84.5715828700,202.900,R5-2 GCP "R5" No.2
1002,46.1870113742,-84.5715860187,203.053,R5-3 GCP "R5" No.3
1003,46.1870087821,-84.5717947099,202.910,R5-4 GCP "R5" No.4
1004,46.1871423580,-84.5717901641,202.922,R5-5 GCP "R5" No.5
1005,46.2159930864,-84.5716630728,207.031,R2-1 GCP "R2" No.1
1006,46.2160548285,-84.5715898442,206.907,R2-2 GCP "R2" No.2
1007,46.2159567158,-84.5715958889,206.842,R2-3 GCP "R2" No.3
1008,46.2159595341,-84.5717193246,206.875,R2-4 GCP "R2" No.4
1009,46.2160450130,-84.5717210675,206.933,R2-5 GCP "R2" No.5
1010,46.2451467360,-84.5924850466,211.120,R4-1 GCP "R4" No.1
1011,46.2451885535,-84.5924081648,210.922,R4-2 GCP "R4" No.2
1012,46.2450965072,-84.5924086203,210.933,R4-3 GCP "R4" No.3
1013,46.2450922316,-84.5925334188,211.020,R4-4 GCP "R4" No.4
1014,46.2451822000,-84.5925362311,211.025,R4-5 GCP "R4" No.5
1015,46.2319067712,-84.5917093551,65.068,L4-13.4VBM Not Good. Memory is full.
1016,46.1725819811,-84.5719508663,214.580,L5-13.0VBM Not Good. Memory is full.

GCP measurement
May 19(Mon) Raco area Day #1

Base Station
Pnt # Latitude Longitude Height Code
3002,46.3589376000,-84.8456664300,280.746,RJ0241
2000,46.3563470300,-84.8038236900,274.367,AIR-001

/*================= Rover No.1 ====================================*/
RTK mode
Pnt # Latitude Longitude Height Code
1000 46.382342331 -84.801919850 276.485 R50 GCP "R50" See notebook.
PP infill mode
Pnt # Latitude Longitude Height Code
1001,46.3901153567,-84.8102929206,278.472,R67-122 Stand 67
1002,46.3903320207,-84.8102212677,279.217,R67-132
1003,46.3905563080,-84.8101885853,279.238,R67-142
1004,46.3907785626,-84.8102541785,279.241,R67-152
1005,46.3910944753,-84.8103553184,279.696,R67-162
1006,46.3913078929,-84.8104376751,279.095,R67-172
1007,46.3915762219,-84.8104398255,279.219,R67-182
1008,46.3917080041,-84.8099755002,280.514,R67-282
1009,46.3914887362,-84.8099043301,279.745,R67-272
1010,46.3912710794,-84.8098207622,279.936,R67-262
1011,46.3909702621,-84.8097178568,281.017,R67-252
1012,46.3905140327,-84.8098087827,279.603,R67-242
1013,46.3902935312,-84.8098721003,279.640,R67-232
1014,46.3900423730,-84.8098969017,279.033,R67-222
1015,46.3898230162,-84.8098215379,278.831,R67-212
1016,46.3897977728,-84.8093393276,278.973,R67-312
1017,46.3900217497,-84.8093710389,279.341,R67-322
1018,46.3902453046,-84.8093827462,279.783,R67-332
1019,46.3905503042,-84.8093388985,280.496,R67-342
1020,46.3907776197,-84.8092989739,280.324,R67-352
1021,46.3909922274,-84.8092192219,279.618,R67-362
1022,46.3912179216,-84.8091899876,279.160,R67-372
1023,46.3914723283,-84.8091766301,279.449,R67-382
1024,46.3914269833,-84.8086793304,279.182,R67-482
1025,46.3912050421,-84.8087161767,278.690,R67-472
1026,46.3909750806,-84.8087802228,279.071,R67-462
1027,46.3906693470,-84.8087550522,280.309,R67-452
1028,46.3903209758,-84.8087292940,280.636,R67-442
1029,46.3900917064,-84.8087105046,279.835,R67-432
1030,46.3898614454,-84.8086914054,280.072,R67-422
1031,46.3900171706,-84.8082189129,280.365,R67-512
1032,46.3901973896,-84.8082417540,280.423,R67-522
1033,46.3904010544,-84.8082495966,280.007,R67-532
1034,46.3905863191,-84.8082545052,279.435,R67-542
1035,46.3908177930,-84.8082667713,278.632,R67-552
1036,46.3910184144,-84.8082729834,278.514,R67-562
1037,46.3911883484,-84.8082880742,279.009,R67-572
1038,46.3914748533,-84.8082972707,279.624,R67-582
1039,46.3895566138,-84.8081602981,278.969,R67-ROAD-5
1040,46.3895728339,-84.8102629235,277.436,R67-ROAD-1

RTK mode

1041 46.358937606 -84.845666811 280.768 MORNING-BM just for checking

/*================= Rover No.2 ====================================*/
RTK mode

Pnt #	Latitude	Longitude	Height	Code	
2000	46.356347028	-84.803823692	274.367	AIR-001	
2001	46.357666139	-84.804970567	274.405	AIR-002	
2002	46.355478178	-84.822579681	275.804	S22B00	measurement failed(Taeyeoul)
2003	46.355351597	-84.822109336	276.011	S22-11	Stand 22
2004	46.354171394	-84.821035328	274.415	S22-51	
2005	46.353626133	-84.818556731	275.137	S22-58	
2006	46.354466206	-84.820438744	275.928	S22-35	
2007	46.354800464	-84.819968989	275.841	S22-18	
2008	46.357666106	-84.804970583	274.421	AIR002	just for checking

No PP infill mode measured by Rover No.2

GCP measurement
May 20(Tue) Raco area Day #2

The data are WGS coordinate.
Base Station
Pnt # Latitude Longitude Height Code
3005,46.3563470306,-84.8038237000,274.367,AIR-001

/*================ Rover No.1 ====================================*/
RTK mode

Pnt #	Latitude	Longitude	Height	Code	
1000	46.356880953	-84.804882997	274.760	R14	GCP at RACO airport runway
1001	46.356454694	-84.824510278	277.009	R15	GCP at RACO airport runway
1002	46.356454703	-84.824510278	277.005	R15-2	GCP at RACO airport runway
1003	46.350713006	-84.819791794	275.375	R16	GCP at RACO airport runway
1004	46.344839564	-84.814679747	275.618	R17	GCP at RACO airport runway
1005	46.375190372	-84.801734792	276.557	R8	GCP at road intersection of 3364&3018
1006	46.367859906	-84.805234450	275.974	R59TEST	Stand 59
1007	46.367592900	-84.805231686	276.150	R59-112	
1008	46.367382475	-84.805204844	275.971	R59-122	
1009	46.367132597	-84.805103519	276.226	R59-132	
1010	46.366978833	-84.804928961	275.749	R59-142	
1011	46.366830272	-84.804683567	275.561	R59-152	
1012	46.366711428	-84.804417706	275.486	R59-162	
1013	46.366592236	-84.804147569	275.362	R59-172	
1014	46.366569769	-84.803842072	275.480	R59-182	
1015	46.366266639	-84.804098531	275.320	R59-282	
1016	46.366438761	-84.804297275	275.381	R59-272	
1017	46.366399100	-84.804613814	275.425	R59-262	
1018	46.366451444	-84.804949319	275.555	R59-252	
1019	46.366455650	-84.805261608	275.679	R59-242	
1020	46.366452578	-84.805576981	276.019	R59-232	
1021	46.366460256	-84.805899608	275.934	R59-222	
1022	46.366428572	-84.806211783	276.098	R59-212	
1023	46.366591547	-84.806216175	276.075	R59-362	
1024	46.366652681	-84.806620786	276.082	R59-352	
1025	46.366637300	-84.806959483	276.326	R59-342	
1026	46.366679486	-84.807268811	276.459	R59-332	
1027	46.366727250	-84.807577419	276.299	R59-322	
1028	46.366768269	-84.807894933	276.352	R59-312	
1029	46.367554586	-84.807303108	273.035	R59-512	
1030	46.367380450	-84.806302281	275.736	R59-522	
1031	46.366949694	-84.806265497	276.068	R59-532	
1032	46.366742656	-84.806250047	275.976	R59-533	
1033	46.366595133	-84.806218267	276.117	R59-542	
1034	46.366392569	-84.806179744	276.069	R59-552	
1035	46.366227781	-84.806186386	276.253	R59-562	
1036	46.366012044	-84.806109253	276.195	R59-572	
1037	46.365798122	-84.806025161	276.012	R59-582	
1038	46.366019486	-84.804992633	275.695	R59-382	
1039	46.366252017	-84.805136383	275.791	R59-372	
1040	46.366452269	-84.805258064	275.652	R59-362	
1041	46.366642639	-84.805354239	275.639	R59-352	

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1042 46.366894772  -84.805420578  275.465 R59-342
1043 46.367089233  -84.805370764  275.960 R59-332
1044 46.367307589  -84.805331878  275.841 R59-322
1045 46.367514544  -84.805241700  276.036 R59-312
1046 46.388173150  -84.803176031  278.957 BASE10    Base candidate
1047 46.381754772  -84.801591100  276.520 R56-112
1048 46.381727869  -84.801276542  275.765 R56-122
1049 46.381775167  -84.801019625  275.205 R56-132
1050 46.381774139  -84.800695314  275.319 R56-142
1051 46.381820583  -84.800283914  277.078 R56-152
1052 46.381824156  -84.799756797  277.343 R56-172
1053 46.381817558  -84.799516517  277.346 R56-182
1054 46.381453267  -84.799394472  277.438 R56-128
1055 46.381447494  -84.799661258  277.330 R56-272
1056 46.381444344  -84.799979831  277.041 R56-262
1057 46.381487336  -84.800279100  276.761 R56-252
1058 46.381418861  -84.800599967  276.757 R56-242
1059 46.381402597  -84.800885431  276.709 R56-232
1060 46.381390578  -84.801252661  277.066 R56-222
1061 46.381399756  -84.801471064  277.307 R56-212
1062 46.381040956  -84.801323078  276.899 R56-312
1063 46.381069522  -84.800996819  276.936 R56-322
1064 46.381117000  -84.800802831  276.956 R56-332
1065 46.381095117  -84.800336811  277.131 R56-342
1066 46.381101233  -84.800076058  277.140 R56-352
1067 46.381084858  -84.799773853  277.180 R56-362
1068 46.381106006  -84.799424650  277.357 R56-372
1069 46.381110975  -84.799053322  277.710 R56-382
1070 46.380703642  -84.799381139  277.522 R56-482
1071 46.380688039  -84.799826900  277.263 R56-472
1072 46.380718872  -84.800131686  277.267 R56-462
1073 46.380698569  -84.800529686  277.323 R56-452
1074 46.380678775  -84.800708064  277.558 R56-42
1075 46.380660481  -84.801010111  277.259 R56-422
1076 46.380692603  -84.801297406  277.173 R56-422
1077 46.380716006  -84.801567478  277.321 R56-412
1078 46.380301953  -84.801541378  277.242 R56-512
1079 46.380306083  -84.801314550  277.083 R56-522
1081 46.380284794  -84.800649306  277.248 R56-542
1082 46.380322958  -84.800381447  277.271 R56-552
1083 46.380300125  -84.800170539  277.420 R56-562
1084 46.380268908  -84.799888894  277.099 R56-572
1085 46.380265614  -84.799541300  277.264 R56-582

No PP infill mode measured by Rover No.1


/*================= Rover No.2 ====================================*/
RTK mode
Pnt # Latitude      Longitude     Height   Code
1007 46.356341622  -84.803834669  274.304 AIR001 Near1 just for checking
1009 46.373175500  -84.770793531  275.514 S58INIT POINTA Stand 58
1010 46.373175528  -84.770793528  275.495 S58INIT POINTB
1011 46.373207139  -84.771116314  275.252 S58-02
1012 46.373248633  -84.771399819  275.353 S58-03
1013 46.373656881  -84.770914731  275.952 S58-21
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1014 46.373723114  -84.771218011  275.377 S58-22
1015 46.373811353  -84.771512831  275.507 S58-23
1016 46.373955225  -84.771633875  275.389 S58-24
1017 46.373891192  -84.771819656  275.171 S58-24
1018 46.374025064  -84.772070636  274.929 S58-25
1019 46.374125456  -84.772357878  274.152 S58-26
1020 46.374254747  -84.772626692  273.309 S58-27
1021 46.374341083  -84.770855900  275.193 S58-41
1022 46.374405289  -84.771090567  275.187 S58-42
1023 46.374537864  -84.771347869  274.912 S58-43
1024 46.374728978  -84.771534067  274.194 S58-44
1025 46.374911622  -84.771728556  273.218 S58-45
1026 46.375153150  -84.771707106  272.882 S58-R5
1027 46.375154547  -84.771377011  273.621 S58-R4
1028 46.375147022  -84.771048308  274.621 S58-R3
1029 46.375143825  -84.770715694  274.917 S58-R2

1030 46.375154703  -84.770503836  274.736 S58-CORNER1 GCP "R42" corner1
1031 46.375151878  -84.770375394  274.802 S58-CORNER2 GCP "R42" corner2
1032 46.375287639  -84.770373375  274.897 S58-CORNER3 GCP "R42" corner3
1033 46.375421111  -84.770367964  275.173 S58-CORNER4 GCP "R42" corner4
1034 46.375418719  -84.770498033  275.033 S58-CORNER5 GCP "R42" corner5
1035 46.375284444  -84.770503714  274.807 S58-CORNER6 GCP "R42" corner6
1036 46.375154783  -84.770503872  274.743 S58-CORNER7 GCP "R42" corner7

PP infill mode
Pnt # Latitude      Longitude     Height   Code
1000,46.4297625588,-84.9061364517,266.469,BM NEAR ST45 ----> GCP "R22" Corner_1
1001,46.4298219199,-84.9061780181,266.578,BM NEAR ST45 ---->BM N_2
1002,46.4297385741,-84.9059882138,266.574,ROAD CORN ST45 --> GCP "R22" Corner_2
1003,46.4295992170,-84.9059718765,266.597,ROAD CORN ST45 --> GCP "R22" Corner_3
1004,46.4296658391,-84.9061221572,266.561,ROAD CORN ST45 --> GCP "R22" Corner_4
1005,46.4296928091,-84.9060537808,266.666,ROAD CORN ST45 --> GCP "R22" Center
1006,46.3576660391,-84.8049707158,274.417,AIR002        just for checking
```

GCP measurement
May 21(Wed) Raco area Day #3

The data are WGS coordinate.
Base Station

Pnt #	Latitude	Longitude	Height	Code
3006	46.356347028	-84.803823703	274.367	AIR001

/*================= Rover No.1 ====================================*/
RTK mode

Pnt #	Latitude	Longitude	Height	Code	
1000	46.365141342	-84.760581550	263.327	R8	
1001	46.385504494	-84.801439514	278.623	R54-512	Stand 54
1002	46.385503156	-84.801135367	278.403	R54-522	
1003	46.385483736	-84.800846850	278.283	R54-532	
1004	46.385526697	-84.800592911	278.335	R54-542	
1005	46.385560511	-84.800309789	278.485	R54-552	
1006	46.385534781	-84.799935033	278.596	R54-562	
1007	46.385575900	-84.799604081	277.816	R54-572	
1008	46.385581953	-84.799320497	277.758	R54-582	
1009	46.385997086	-84.799440678	277.891	R54-482	
1010	46.386000525	-84.799716156	278.197	R54-472	
1011	46.385976581	-84.799984422	278.171	R54-462	
1012	46.385971439	-84.800298667	278.591	R54-452	
1013	46.385934336	-84.800598531	278.632	R54-442	
1014	46.385912131	-84.800856125	278.358	R54-432	
1015	46.385869464	-84.801166189	278.731	R54-422	
1016	46.385879886	-84.801516889	278.453	R54-412	
1017	46.385150022	-84.801507142	278.407	R54-512	
1018	46.385150239	-84.801249689	278.519	R54-522	
1019	46.385162486	-84.800947769	278.182	R54-532	
1020	46.385143875	-84.800654514	278.486	R54-542	
1021	46.385132667	-84.800303267	278.728	R54-552	
1022	46.385140600	-84.800032214	278.225	R54-562	
1023	46.385147783	-84.799744192	278.376	R54-572	
1024	46.385159828	-84.799412533	278.603	R54-582	
1025	46.386210422	-84.801457542	278.818	R54-212	
1026	46.386239714	-84.801160500	278.529	R54-222	
1027	46.386231797	-84.800875278	278.539	R54-232	
1028	46.386296067	-84.800557400	278.803	R54-242	
1029	46.386335042	-84.800209319	278.276	R54-252	
1030	46.386369461	-84.799964786	278.784	R54-262	
1031	46.386380383	-84.799609989	278.452	R54-272	
1032	46.386368272	-84.799263061	277.890	R54-282	
1033	46.386697239	-84.799445269	278.516	R54-182	
1034	46.386705694	-84.799765408	278.469	R54-172	
1035	46.386682714	-84.800045892	278.264	R54-162	
1036	46.386645822	-84.800314056	277.676	R54-152	
1037	46.386656178	-84.800673644	277.277	R54-142	
1038	46.386621808	-84.800960789	278.008	R54-132	
1039	46.386511114	-84.801369583	277.762	R54-122	
1040	46.386552322	-84.801523122	277.776	R54-112	
1041	46.386618967	-84.801911567	277.683	R54-BL0	
1042	46.384820889	-84.801858075	278.342	R54-BL1	
1043	46.384820964	-84.801858122	277.836	R54-BL1	

1044	46.389788078	-84.796109789	278.896	R38-112	Stand 38
1045	46.390036983	-84.796109189	279.268	R38-122	
1046	46.390183119	-84.795913369	279.074	R38-132	
1047	46.390329922	-84.795816925	278.758	R38-142	
1048	46.390522706	-84.795733733	278.202	R38-152	
1049	46.390733875	-84.795668756	278.271	R38-162	
1050	46.391069258	-84.795546231	277.347	R38-172	
1051	46.391287794	-84.795465983	277.334	R38-182	
1052	46.391128256	-84.794847697	277.404	R38-272	
1053	46.391361900	-84.794786933	277.260	R38-282	
1054	46.390920581	-84.794960822	277.553	R38-262	
1055	46.390713097	-84.795088717	277.870	R38-252	
1056	46.390516894	-84.795221828	277.924	R38-242	
1057	46.390290008	-84.795272328	278.026	R38-232	
1058	46.390077350	-84.795438981	278.482	R38-222	
1059	46.389861364	-84.795520647	277.850	R38-212	
1060	46.389812314	-84.795140675	278.035	R38-312	
1061	46.390006033	-84.795022558	278.066	R38-322	
1062	46.390254894	-84.794928458	277.885	R38-332	
1063	46.390464608	-84.794827725	277.689	R38-342	
1064	46.390685453	-84.794720667	277.516	R38-352	
1065	46.390851478	-84.794634239	277.585	R38-362	
1066	46.391086333	-84.794524806	277.147	R38-372	
1067	46.391277142	-84.794463422	277.210	R38-382	
1068	46.391362403	-84.793874522	277.170	R38-482	
1069	46.391135822	-84.793959447	277.271	R38-472	
1070	46.390932669	-84.794045286	277.370	R38-462	
1071	46.390706269	-84.794187758	277.540	R38-452	
1072	46.390521025	-84.794271525	276.900	R38-442	
1073	46.390293514	-84.794358097	277.087	R38-432	
1074	46.390076908	-84.794472142	277.417	R38-422	
1075	46.389862158	-84.794580181	277.718	R38-412	
1076	46.389802475	-84.794059039	277.326	R38-512	
1077	46.390001525	-84.793913897	277.609	R38-522	
1078	46.390213992	-84.793801447	277.363	R38-532	
1079	46.390409206	-84.793743683	276.543	R38-542	
1080	46.390643928	-84.793591692	277.570	R38-552	
1081	46.390850350	-84.793438794	277.390	R38-562	
1082	46.391071264	-84.793350325	277.333	R38-572	
1083	46.391262450	-84.793248003	277.565	R38-582	
1084	46.389658639	-84.793659053	276.843	R38-bl0	
1085	46.389653581	-84.796257856	279.639	R38-bl1	
1086	46.340864353	-84.905768011	278.491	R80-11	Stand 80
1087	46.340898856	-84.906358378	277.688	R80-12	
1088	46.340901892	-84.906962819	277.804	R80-13	
1089	46.340962608	-84.907612953	277.756	R80-14	
1090	46.340600489	-84.907754861	278.331	R80-24	
1091	46.340570142	-84.907307519	278.925	R80-23	
1092	46.340560278	-84.906891783	278.904	R80-22	
1093	46.340523606	-84.906372950	279.138	R80-21	
1094	46.340255472	-84.906200339	279.267	R80-31	
1095	46.340279442	-84.906699783	279.324	R80-32	
1096	46.340322158	-84.907171717	279.122	R80-33	
1097	46.340348314	-84.907703256	278.778	R80-34	
1098	46.339919667	-84.907718475	279.028	R80-44	

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1099 46.339957861  -84.907255611  279.110 R80-43
1100 46.340021633  -84.906807128  279.471 R80-42
1101 46.340051022  -84.906184628  279.336 R80-41

No PP infill mode measured by Rover No.1

/*================= Rover No.2 ====================================*/
RTK mode
Pnt # Latitude      Longitude     Height   Code
2000 46.367813819  -84.812976461  276.940 S61-R1   Stand 61
2001 46.367538775  -84.813256864  277.033 S61-T11
2003 46.366957700  -84.813403606  277.028 S61-T13
2004 46.366959606  -84.813406689  277.034 S61-T13
2005 46.366164253  -84.813711631  277.565 S61-T15
2006 46.366169942  -84.814388119  277.213 S61-T15
2007 46.367847589  -84.813896900  277.483 S61-R2
2008 46.367845217  -84.814411350  277.629 S61-R3
2009 46.367859342  -84.814802392  277.833 S61-R4
2010 46.367850494  -84.815340022  278.125 S61-R5
2011 46.367411161  -84.815059242  277.611 S61-T42
2012 46.367157322  -84.815114481  277.333 S61-T52

2014 46.367783572  -84.786611078  273.305 S68-R1   Stand 68
2015 46.367791731  -84.786089939  273.340 S68-R2
2016 46.367798503  -84.785581544  273.161 S68-R3
2017 46.367803117  -84.785068611  273.929 S68-R4
2018 46.367798425  -84.784539567  273.677 S68-R5
2019 46.368418719  -84.784632419  274.303 S68-T51
2020 46.368414850  -84.784629156  273.282 S68-T51
2021 46.369071008  -84.784691983  273.143 S68-T52
2022 46.369512683  -84.784717133  274.117 S68-T53
2023 46.369277558  -84.784869981  272.761 S68-T54
2025 46.369436500  -84.786126814  273.654 S68-T45
2026 46.369444392  -84.786620183  273.580 S68-T35
2027 46.369376408  -84.787182458  274.931 S68-T25
2028 46.368768047  -84.787050372  275.052 S68-T32
2029 46.368676894  -84.786991508  272.730 S68-T31
2030 46.368651675  -84.786410053  273.519 S68-T21
2031 46.368747019  -84.785859956  272.979 S68-T22
2032 46.368739253  -84.785120672  273.047 S68-T23
2033 46.356350897  -84.803821389  274.302 AIR-001 just for checking

No PP infill mode measured by Rover No.2
```

GCP measurement
May 22(Thursday) Raco area Day #4

The data are WGS coordinate.
Base Station
Pnt # Latitude Longitude Height Code
3002,46.3881731700,-84.8031762400,278.946,BASE10A

/*================= Rover No.1 ====================================*/
RTK mode

Pnt #	Latitude	Longitude	Height	Code	
1000	46.388173172	-84.803176236	278.946	R8	
1001	46.388166236	-84.803181056	278.938	R8-CHECK	
1002	46.382977881	-84.807120883	273.131	R66-11	Stand 66
1003	46.382977933	-84.807120892	273.635	R66-112	
1004	46.383351053	-84.807208094	274.095	R66-12	
1005	46.383802664	-84.807285931	273.528	R66-13	
1006	46.384324011	-84.807254783	273.886	R66-14	
1007	46.384126281	-84.807694833	273.190	R66-24	
1008	46.383911286	-84.807682567	272.555	R66-23	
1009	46.383667886	-84.807757156	272.101	R66-22.9	
1010	46.383421642	-84.807834303	272.387	R66-22.3	
1011	46.383188706	-84.807929464	272.695	R66-25	
1012	46.382978575	-84.807938097	273.046	R66-26	
1013	46.382792661	-84.807895261	272.503	R66-27	
1014	46.382948294	-84.808358242	272.113	R66-41	
1015	46.383137072	-84.808178281	272.584	R66-42	
1016	46.383347686	-84.808017217	272.193	R66-43	
1017	46.383554844	-84.807833181	272.358	R66-44	
1018	46.383751947	-84.807661597	272.549	R66-45	
1019	46.383922425	-84.807499028	273.542	R66-46	
1020	46.384081192	-84.807387072	274.037	R66-47	
1021	46.384262981	-84.807244036	273.978	R66-48	
1022	46.384116369	-84.806909236	274.901	R66-38	
1023	46.383932647	-84.807043806	274.192	R66-37	
1024	46.383778628	-84.807175783	273.538	R66-36	
1025	46.383595239	-84.807294456	273.327	R66-35	
1026	46.383386392	-84.807483767	273.329	R66-34	
1027	46.383195089	-84.807615903	273.154	R66-33	
1028	46.383026636	-84.807744708	272.986	R66-32	
1029	46.382845403	-84.807836383	272.552	R66-31	
1030	46.398455031	-84.795589928	281.691	R55-11	Stand 55
1031	46.398676514	-84.795176511	281.377	R55-12	
1032	46.398904494	-84.794775864	281.526	R55-13	
1033	46.399215561	-84.794534700	280.996	R55-14	
1034	46.399607292	-84.794845378	280.100	R55-24	
1035	46.399377392	-84.795316981	280.923	R55-23	
1036	46.399239753	-84.795645567	281.301	R55-22	
1037	46.399109081	-84.796099161	281.420	R55-21	
1038	46.399294797	-84.796416011	281.740	R55-31	
1039	46.399468872	-84.796112136	281.217	R55-32	
1040	46.399741500	-84.795581458	281.090	R55-33	
1041	46.399909403	-84.795213953	279.879	R55-34	
1042	46.400113900	-84.795537344	280.331	R55-44	

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1043 46.399919100  -84.795876806  281.364 R55-43
1044 46.399730617  -84.796282606  281.571 R55-42
1045 46.399546383  -84.796595486  281.639 R55-41
1046 46.399702561  -84.796989983  281.992 R55-51

PP infill mode
Pnt #  Latitude       Longitude   Height  Code
1047,46.4048937315,-84.7386432491,271.272,R69-11 Stand 69
1048,46.4049365707,-84.7383223638,271.287,R69-12
1049,46.4047676075,-84.7379993578,271.927,R69-13
1050,46.4055185944,-84.7382674861,178.112,R69-14 Not Good. Memory was full
1051,46.4049030472,-84.7384378667,227.756,R69-15 Not Good. Memory was full
1052,46.4054099000,-84.7384945694,341.713,R69-17 Not Good. Memory was full
1053,46.4057799194,-84.7381197528,249.478,R69-18 Not Good. Memory was full


/*================= Rover No.2 ====================================*/
RTK mode
Pnt #  Latitude       Longitude   Height  Code
2000 46.356348533  -84.803822056  274.356 AIR001 just for checking
2001 46.390223167  -84.765548475  274.429 S71-T11 Stand 71
2002 46.390194797  -84.765147622  272.827 S71-T21
2003 46.390215258  -84.764702297  272.162 S71-T31
2004 46.390183361  -84.763911497  272.069 S71-T41
2005 46.390283386  -84.763241019  273.058 S71-T51
2007 46.390746569  -84.763620067  272.409 S71-T52
2008 46.390911217  -84.765158344  272.135 S71-T22
2009 46.390762506  -84.766047581  275.468 S71-T12
2010 46.391341567  -84.766071275  274.738 S71-T13
2011 46.391439022  -84.765572256  272.299 S71-T23
2012 46.391597147  -84.763916400  272.245 S71-T53

2013 46.389923261  -84.762884100  273.479 S72-T11 Stand 72
2014 46.389964342  -84.762104206  273.053 S72-T31
2015 46.389974114  -84.761145825  272.680 S72-T51
2016 46.390406753  -84.761218017  275.077 S72-T52
2017 46.390316242  -84.762203517  274.749 S72-T22
2018 46.390694903  -84.762436144  274.913 S72-T23
2019 46.391101447  -84.762864014  272.734 S72-T24
2020 46.391200369  -84.761974664  272.160 S72-T34
2021 46.391426872  -84.760631175  273.924 S72-T44
2022 46.391803644  -84.760716350  271.040 S72-T45
2023 46.392210481  -84.760845792  272.423 S72-T46
2024 46.392194483  -84.761957697  272.435 S72-T26

2025 46.391111836  -84.755114625  274.096 S40-T11 Stand 40
2026 46.390988736  -84.754577050  274.374 S40-T21
2027 46.391564658  -84.754977950  272.450 S40-T23
2028 46.391555519  -84.754448842  272.871 S40-T33
2029 46.391556806  -84.753937856  272.918 S40-T43
2030 46.391549497  -84.753373394  272.982 S40-T53
2031 46.391648186  -84.752932339  273.744 S40-T63
2032 46.391752728  -84.752380517  274.171 S40-T73
2033 46.391781081  -84.751774747  274.685 S40-T83
2034 46.391238889  -84.751523853  274.721 S40-T82
2035 46.390324272  -84.751265589  274.390 S40-T81
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2036 46.390388747 -84.751728369 273.930 S40-T71
2037 46.390575847 -84.752711903 273.748 S40-T61
2038 46.390791981 -84.753706117 274.284 S40-T51
2039 46.390976528 -84.754567169 274.471 S40-T41

PP infill mode
Pnt # Latitude Longitude Height Code
2040,46.4042942552,-84.7392223628,272.399,R21A GCP "R21" No.1
2041,46.4044018162,-84.7392304077,272.365,R21B GCP "R21" No.2
2042,46.4043883303,-84.7391176508,272.431,R21C GCP "R21" No.3
2043,46.4042878505,-84.7391207019,272.440,R21D GCP "R21" No.4
2044,46.4041332027,-84.7391172883,272.454,R21E GCP "R21" No.5
2045,46.4040676061,-84.7391176308,272.468,R21F GCP "R21" No.6
2046,46.4040730130,-84.7392110507,272.476,R21G GCP "R21" No.7
2047,46.4041331362,-84.7392097999,272.479,R21H GCP "R21" No.8
2048,46.4040949452,-84.7391640552,272.561,R21I GCP "R21" No.9
2049,46.4043478102,-84.7391624788,272.504,R21J GCP "R21" No.10
2050,46.3696386596,-84.7392186814,202.125,R18A Not Good. Memory was full
2051,46.3692960958,-84.7388804146,199.837,R18B Not Good. Memory was full
2052,46.3692526867,-84.7388282896,154.804,R18C Not Good. Memory was full
2053,46.3692066236,-84.7391163874,174.292,R18D Not Good. Memory was full
2054,46.3753719534,-84.7389104231,204.387,R19A Not Good. Memory was full
2055,46.3750873072,-84.7388523601,196.343,R19E Not Good. Memory was full
2056,46.3751883760,-84.7387607832,197.745,R19B Not Good. Memory was full
2057,46.3751714324,-84.7390817597,268.893,R19C Not Good. Memory was full
2058,46.3750818698,-84.7387220582,212.382,R19D Not Good. Memory was full
2059,46.3896185989,-84.7391013943,263.278,R20E Not Good. Memory was full
2060,46.3898563539,-84.7392369441,243.927,R20A Not Good. Memory was full
2061,46.3898819871,-84.7391537674,277.634,R20B Not Good. Memory was full
2062,46.3897391906,-84.7391128107,291.512,R20C Not Good. Memory was full
2063,46.3896612350,-84.7391497828,276.082,R20D Not Good. Memory was full
2064,46.3897006541,-84.7390836882,242.232,R20D Not Good. Memory was full

GCP measurement
May 23(Friday) Raco area Day #5

The data are WGS coordinate.
Base Station
Pnt # North East Height Code
3001,46.3563470300,-84.8038237000,274.367,AIR001

/*================= Rover No.1 ====================================*/
No RTK mode measurement was done by Rover No.2

PP infill mode
Pnt # Latitude Longitude Height Code
1000,46.4365839577,-84.9187931110,255.337,R45-11 Stand 45
1001,46.4366218777,-84.9184608646,255.601,R45-12
1002,46.4374355212,-84.9176143379,255.150,R45-13
1003,46.4372892501,-84.9174154600,254.983,R45-23
1004,46.4372894440,-84.9174157271,255.543,R45-23
1005,46.4369403120,-84.9171518857,255.732,R45-33
1006,46.4365483460,-84.9170620612,255.869,R45-32
1007,46.4365480911,-84.9175889154,255.826,R45-33
1008,46.4365978184,-84.9180329024,255.833,R45-34
1009,46.4366627572,-84.9183520006,255.699,R45-35
1010,46.4362817201,-84.9184352662,255.268,R45-41
1011,46.4360954328,-84.9180471209,255.561,R45-42
1012,46.4362133052,-84.9175049734,255.493,R45-43
1013,46.4362134354,-84.9175049825,255.487,R45-43
1014,46.4362293337,-84.9169745528,255.944,R45-44
1015,46.4360253642,-84.9170291355,255.799,R45-54
1016,46.4358002985,-84.9173617144,256.713,R45-53

1017,46.4297585419,-84.9076556245,276.400,S34-11 Stand 34
1018,46.4297583075,-84.9076557435,268.706,S34-11
1019,46.4283677891,-84.9085358781,270.109,S34-18
1020,46.4300459221,-84.9096448955,269.077,S34-3
1021,46.4295527084,-84.9100049274,197.634,S34-54 Not Good. Memory was full
1022,46.4291308060,-84.9102622806,242.284,S34-54 Not Good. Memory was full

/*================= Rover No.2 ====================================*/
No RTK mode measurement was done by Rover No.2

PP infill mode
Pnt # Latitude Longitude Height Code
2000,46.4339206424,-84.9060179304,256.163,S31-R1 Stand 31
2001,46.4339082715,-84.9050283954,256.342,S31-T1
2002,46.4327372279,-84.9046723278,256.645,S31-T2
2003,46.4324554032,-84.9060329670,257.515,S31-R5

2004,46.4309067575,-84.9012592083,257.559,S49-BASE1 Stand 49
2005,46.4303569257,-84.9017260754,259.287,S49-BASE2
2006,46.4305381461,-84.9011065354,259.541,S49-T11
2007,46.4303660329,-84.9010633171,258.197,S49-T12
2008,46.4302623675,-84.9005200489,205.246,S49-T13
2009,46.4300308731,-84.9009847520,259.731,S49-T23

2010,46.4298352713,-84.9011805030,261.339,S49-T24
2011,46.4297100957,-84.9011904800,262.448,S49-T25
2012,46.4296476971,-84.9012287543,263.229,S49-T35
2013,46.4295384146,-84.9013181699,263.618,S49-T45
2014,46.4296505475,-84.9014200266,263.711,S49-T46
2015,46.4297327994,-84.9013710273,262.966,S49-T35
2016,46.4297933404,-84.9014471757,262.133,S49-T36
2017,46.4299891044,-84.9016304519,261.663,S49-T34
2018,46.4300136680,-84.9017078434,261.811,S49-T33
2019,46.4300791292,-84.9017117465,260.945,S49-T32
2020,46.4301459191,-84.9017549974,260.450,S49-T331
2021,46.4302067742,-84.9017837576,260.139,S49-T31
2022,46.4300712672,-84.9020575414,261.314,S49-T3ROAD
2023,46.4297600451,-84.9022895670,263.478,S49-T41
2024,46.4296037331,-84.9022320765,263.931,S49-T42
2025,46.4296432952,-84.9019489311,263.854,S49-T43
2026,46.4295179658,-84.9017728642,263.967,S49-T44

GCP measurement
May 24(Saturday) Raco area Day #6

The data are WGS coordinate.
Base Station

Pnt #	Latitude	Longitude	Height	Code	
3001	46.429762561	-84.906136458	266.469	R22-AT-CORNER	located at Mc Nearney Lake
5001	46.358937600	-84.845666433	280.746	RJ0241	located at Raco
6001	46.187288400	-84.562248133	204.000	RJ1102	located at Rudyard

/*================= Rover No.1 ====================================*/
RTK mode

Pnt #	Latitude	Longitude	Height	Code	
1000	46.431094403	-84.910565575	268.339	R33-11	Stand 33
1001	46.431391442	-84.911817011	269.639	R33-31	
1002	46.431715600	-84.912801706	269.574	R33-51	
1003	46.431896214	-84.912336172	269.344	R33-53	
1004	46.432338517	-84.912333939	269.554	R33-58	
1005	46.431849892	-84.911089378	268.382	R33-34	
1006	46.431998686	-84.910379150	267.223	R33-18	

1020	46.230411150	84.571541517	210.555	IT33-1	GCP "R33" No.1 (Rudyard area)
1021	46.230394158	84.571827400	210.142	IT33-2	Not Good. (by Yi-Cheng)
1022	46.230559117	84.571815422	210.235	IT33-3	Not Good. (by Yi-Cheng)
1023	46.230559069	84.571815319	210.620	IT33-32	GCP "R33" No.2 (Rudyard area)
1024	46.230559042	84.571612122	210.558	IT33-42	GCP "R33" No.3 (Rudyard area)
1025	46.230471825	84.550923908	209.141	IT34-1	GCP "R34" No.1 (Rudyard area)
1026	46.230474958	84.550780092	209.158	IT34-2	GCP "R34" No.2 (Rudyard area)
1027	46.230584964	84.550770667	209.170	IT34-3	GCP "R34" No.3 (Rudyard area)

PP infill mode

Pnt #	Latitude	Longitude	Height	Code	
1007,	46.3942790996,	-84.9706821837,	278.604,	R85-1	Stand 85
1008,	46.3694893633,	-84.7388115976,	259.044,	IT-1	GCP "R18" No.1
1009,	46.3694390760,	-84.7390001988,	259.091,	IT-2	GCP "R18" No.2
1010,	46.3693180115,	-84.7388104672,	258.946,	IT-3	GCP "R18" No.3
1011,	46.3732296627,	-84.7390470582,	259.416,	IT19-1	GCP "R19" No.1
1012,	46.3733355559,	-84.7390545540,	259.473,	IT19-2	GCP "R19" No.2
1013,	46.3733039973,	-84.7389944168,	259.513,	IT19-3	GCP "R19" No.3
1014,	46.3896860152,	-84.7390268249,	266.384,	IT20-1	GCP "R20" No.1
1015,	46.3896005033,	-84.7390261682,	266.409,	IT20-2	GCP "R20" No.2
1016,	46.3895905163,	-84.7391350773,	266.300,	IT20-3	GCP "R20" No.3
1017,	46.3751789172,	-84.7809876803,	275.045,	IT31-1	GCP "R31" No.1
1018,	46.3751902311,	-84.7808610433,	274.628,	IT31-2	GCP "R31" No.2
1019,	46.3752989637,	-84.7808818752,	274.445,	IT31-3	GCP "R31" No.3

/*================= Rover No.2 ====================================*/
RTK mode

Pnt #	Latitude	Longitude	Height	Code	
2000	46.426453714	-84.900390139	268.155	S50-T1	Stand 50
2001	46.426775761	-84.899897294	266.754	S50-T12	
2002	46.427709986	-84.898846422	264.892	S50-T13	

```
2003 46.427754147  -84.898418281  264.534 S50-T23
2004 46.425699444  -84.898554119  268.047 S50-R4
2005 46.425727914  -84.899038236  268.416 S50-R4A
2006 46.425772539  -84.899008414  268.635 S50-R4B
2007 46.425977581  -84.899728903  267.909 S50-R3
2019 46.358734100  -84.829831186  278.615 R10NEAR  GCP "R10Near"
2020 46.375215489  -84.833054431  283.468 R10E     Center of intersection "R10"
2021 46.356631278  -84.893252253  282.384 R30      GCP "R30"
2022 46.358503917  -84.893683442  281.662 R6       GCP "R6"
2023 46.367233003  -84.893898458  277.844 R78      GCP "R7" No.1
2024 46.367112186  -84.893884428  276.955 R78E     GCP "R7" No.2
2025 46.351503847  -84.905825956  275.119 R24      GCP "R24"

PP infill mode
Pnt #  Latitude       Longitude   Height  Code
2008,46.4549477881,-84.9058569749,205.738,R11F          GCP "R11" No.1
2009,46.4549553575,-84.9059144442,205.665,R11E          GCP "R11" No.2 (Center)
2010,46.4555509192,-84.9059012910,204.829,R11NEAR1      Near "R11"
2011,46.4569101202,-84.9058848591,205.425,R11NEAR-HILL1 Near "R11"
2012,46.4586133798,-84.9058626065,205.821,CRYDERMAN1    GCP "R40"
2013,46.4649589117,-84.9058862222,185.549,CORNER-LAKE   GCP "R41"
2014,46.4730625042,-84.9573431082,213.650,R12A          GCP "R12" No.1
2015,46.4731295504,-84.9569849900,214.061,R12B          GCP "R12" No.2
2016,46.4729805411,-84.9566907434,214.475,R12C          GCP "R12" No.3
2017,46.4865157492,-85.0394154128,211.261,R13A          GCP "R13" No.1
2018,46.4865525296,-85.0393407835,206.746,R13B       Not Good. (by Yutaka)
```

Appendix B: Data of Each Stand

Table B-1 shows the information on measured stands.
Figure B-1 shows location of each stand .
The detail data record is shown afterwards.
All the data are expressed on WGS coordinate.
Including the cover sheet, **appendix B** is totally 28 pages.

Table B-1 GPS measurement results at each stand (1 of 2)

Raco Area

Stand No.	Tree description 1)	Tree Mean Height (m) 1)	Mode	Measured Date	Valid point	In-valid point	GPS measured Height Average (m)	Minimun (m)	Maximum (m)	Std.dev. (m)
22	Red Pine (sa) 2)	8.74 (1994)	RTK 3)	5/19 (Mon)	5	1	275.466	274.415	276.011	0.683
38	Jack Pine(sa)	5	RTK	5/21 (Wed)	42	0	277.722	276.543	279.639	0.658
40	Red Pine (seedling)	2-3	RTK	5/22 (Thu)	15	0	273.856	272.450	274.721	0.723
54	Jack Pine(sa)	5	RTK	5/21 (Wed)	43	0	278.292	277.277	278.818	0.364
55	Jack Pine(sa)	5	RTK	5/22 (Thu)	17	0	281.186	279.879	281.992	0.589
56	Jack 2) Pine(ma)	11	RTK	5/20 (Mon)	39	0	277.042	275.205	277.710	0.540
58	Jack Pine(sa)	3	RTK	5/20 (Mon)	21	0	274.769	272.882	275.952	0.869
59	Jack Pine(sa)	6	RTK	5/20 (Mon)	40	0	275.884	275.320	276.459	0.311
61	Jack Pine(ma)	13	RTK	5/21 (Wed)	13	0	277.402	276.940	278.125	0.370
66	Jack Pine (seedling)		RTK	5/22 (Thu)	28	0	273.146	272.101	274.901	0.724
67	Jack Pine(ma)	15	Infill 3)	5/19 (Mon)	40	0	279.496	277.436	281.017	0.711
68	Red Pine (pole)	11	RTK	5/21 (Wed)	19	0	273.584	272.730	275.052	0.667
69	Aspen (sa)	6	Infill	5/22 (Thu)	3	4	271.495	271.272	271.927	0.374
71	Red Pine (pole)	11	RTK	5/22 (Thu)	12	0	273.076	272.069	275.468	1.219
72	Red Pine (pole)	14	RTK	5/22 (Thu)	12	0	273.222	271.040	275.077	1.239
80	Red Pine (seedling)	2-3	RTK	5/21 (Wed)	16	0	278.780	277.688	279.471	0.592

Remark 1) Tree description and tree mean height information are acquired from the following reference.
"Structure, Composition, and Above-ground Biomass of SIR-C/X- SAR and ERS-1 Forest Test Stands 1991-1994, Raco Michigan Site"
Kathleen M.Bergen, M.Craig Dobson, Terry L.Sharik, Ian Brodie
October 30,1995 , Report 026511-7-T

Remark 2) The meanings of abbreviation are shown below.
(ma): mature
(sa): sapling

Remark 3) The meanings of abbreviation are shown below.
(RTK): realtime kinematic mode
(Infill): postprocessing infill mode

Table B-1 GPS measurement results at each stand (2 of 2)

Mc Nearney Lake area

Stand No.	Tree description 1)	Tree Mean Height (m) 1)	Mode	Measured Date	Valid point	Invalid point	GPS measured Height Average (m)	Minimum (m)	Maximum (m)	Std.dev
31	Hardwood (ma) 2)	18	Infill 3)	5/23 (Fri)	4	0	256.666	256.163	257.515	0.600
33	Aspen(sa) 2)	12	3)RTK	5/24 (Sat)	7	0	268.865	267.223	269.639	0.914
34	Hardwood (ma)	20	Infill	5/23 (Fri)	4	2	271.073	268.706	276.400	3.601
45	Aspen(sa)	3	Infill	5/23 (Fri)	17	0	255.638	254.983	256.713	0.385
49	Aspen(sa)	6	Infill	5/23 (Fri)	22	1	261.605	257.559	263.967	1.937
50	Red Pine (ma)	16	RTK	5/24 (Sat)	8	0	267.168	264.534	268.635	1.617
85	Hardwood (ma)	15	Infill	5/24 (Sat)	1	0	278.604	278.604	278.604	0.000

Remark 1) Tree description and tree mean height information are acquired from the following reference.
"Structure, Composition, and Above-ground Biomass of SIR-C/X- SAR and ERS-1 Forest Test Stands 1991-1994, Raco Michigan Site"
Kathleen M.Bergen, M.Craig Dobson, Terry L.Sharik, Ian Brodie
October 30,1995 , Report 026511-7-T

Remark 2) The meanings of abbreviation are shown below.
(ma): mature
(sa): sapling

Remark 3) The meanings of abbreviation are shown below.
(RTK): realtime kinematic mode
(Infill): postprocessing infill mode

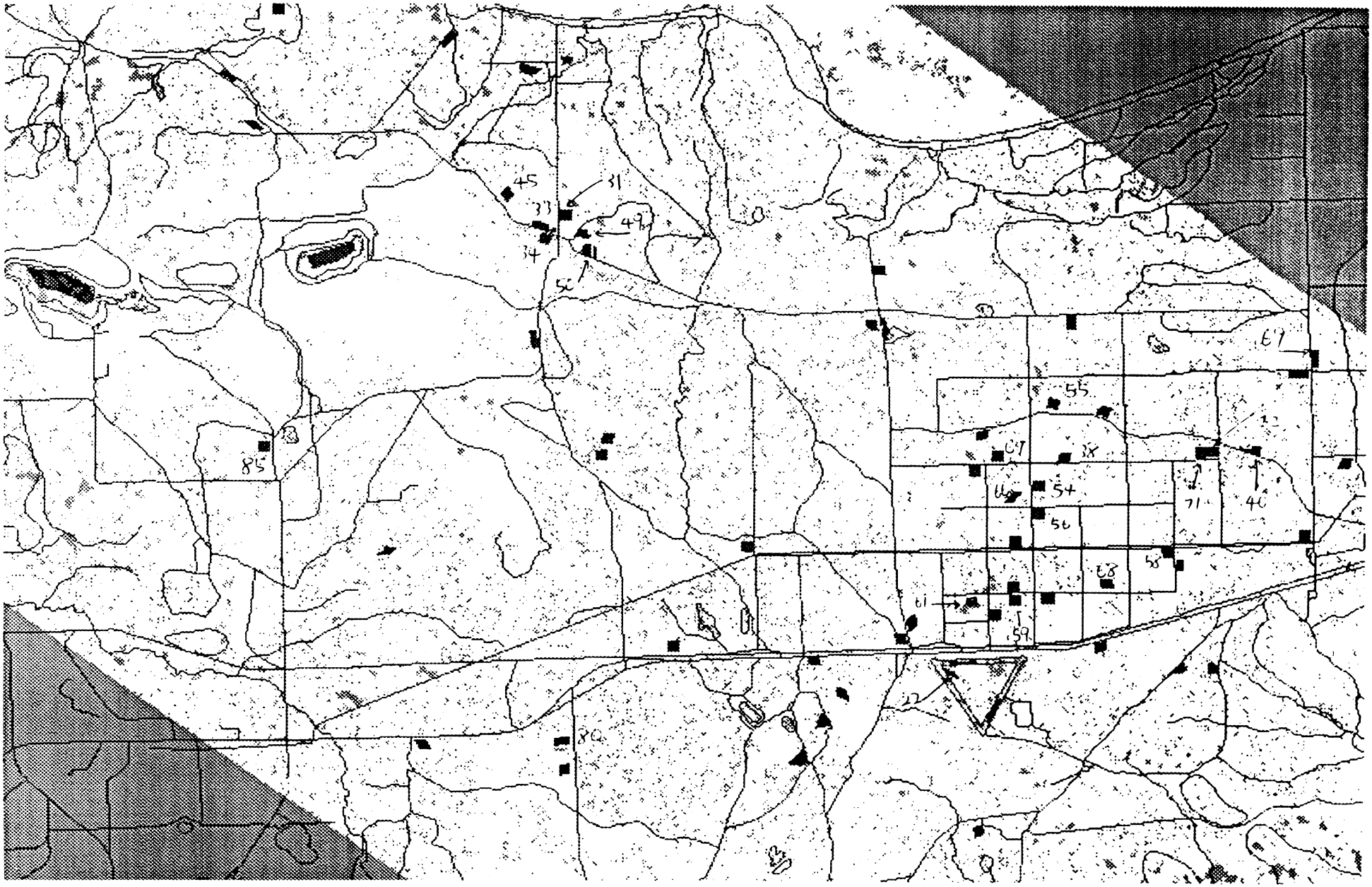

Figure B-1 Stand Location (Totally 23 stands)

GCP measurement at Stand 22
May 19(Mon) Raco area Day #1

Pnt #	Latitude	Longitude	Height	Code
2003	46.355351597	-84.822109336	276.011	S22-11
2004	46.354171394	-84.821035328	274.415	S22-51
2005	46.353626133	-84.818556731	275.137	S22-58
2006	46.354466206	-84.820438744	275.928	S22-35
2007	46.354800464	-84.819968989	275.841	S22-18

GCP measurement at Stand 31
May 23(Friday) Raco area Day #5

Pnt #	Latitude	Longitude	Height	Code
2000	46.4339206424	-84.9060179304	256.163	S31-R1
2001	46.4339082715	-84.9050283954	256.342	S31-T1
2002	46.4327372279	-84.9046723278	256.645	S31-T2
2003	46.4324554032	-84.9060329670	257.515	S31-R5

GCP measurement at Stand 33
May 24(Saturday) Raco area Day #6

Pnt #	Latitude	Longitude	Height	Code
1000	46.431094403	-84.910565575	268.339	R33-11
1001	46.431391442	-84.911817011	269.639	R33-31
1002	46.431715600	-84.912801706	269.574	R33-51
1003	46.431896214	-84.912336172	269.344	R33-53
1004	46.432338517	-84.912333939	269.554	R33-58
1005	46.431849892	-84.911089378	268.382	R33-34
1006	46.431998686	-84.910379150	267.223	R33-18

GCP measurement at Stand 34
May 23(Friday) Raco area Day #5

Pnt #	Latitude	Longitude	Height	Code
1017	46.4297585419	-84.9076556245	276.400	S34-11
1018	46.4297583075	-84.9076557435	268.706	S34-11
1019	46.4283677891	-84.9085358781	270.109	S34-18
1020	46.4300459221	-84.9096448955	269.077	S34-3

GCP measurement at Stand 38
May 21(Wed) Raco area Day #3

Pnt #	Latitude	Longitude	Height	Code
1044	46.389788078	-84.796109789	278.896	R38-112
1045	46.390036983	-84.796109189	279.268	R38-122
1046	46.390183119	-84.795913369	279.074	R38-132
1047	46.390329922	-84.795816925	278.758	R38-142
1048	46.390522706	-84.795733733	278.202	R38-152
1049	46.390733875	-84.795668756	278.271	R38-162
1050	46.391069258	-84.795546231	277.347	R38-172
1051	46.391287794	-84.795465983	277.334	R38-182
1052	46.391128256	-84.794847697	277.404	R38-272
1053	46.391361900	-84.794786933	277.260	R38-282
1054	46.390920581	-84.794960822	277.553	R38-262
1055	46.390713097	-84.795088717	277.870	R38-252
1056	46.390516894	-84.795221828	277.924	R38-242
1057	46.390290008	-84.795272328	278.026	R38-232
1058	46.390077350	-84.795438981	278.482	R38-222
1059	46.389861364	-84.795520647	277.850	R38-212
1060	46.389812314	-84.795140675	278.035	R38-312
1061	46.390006033	-84.795022558	278.066	R38-322
1062	46.390254894	-84.794928458	277.885	R38-332
1063	46.390464608	-84.794827725	277.689	R38-342
1064	46.390685453	-84.794720667	277.516	R38-352
1065	46.390851478	-84.794634239	277.585	R38-362
1066	46.391086333	-84.794524806	277.147	R38-372
1067	46.391277142	-84.794463422	277.210	R38-382
1068	46.391362403	-84.793874522	277.170	R38-482
1069	46.391135822	-84.793959447	277.271	R38-472
1070	46.390932669	-84.794045286	277.370	R38-462
1071	46.390706269	-84.794187758	277.540	R38-452
1072	46.390521025	-84.794271525	276.900	R38-442
1073	46.390293514	-84.794358097	277.087	R38-432
1074	46.390076908	-84.794472142	277.417	R38-422
1075	46.389862158	-84.794580181	277.718	R38-412
1076	46.389802475	-84.794059039	277.326	R38-512
1077	46.390001525	-84.793913897	277.609	R38-522
1078	46.390213992	-84.793801447	277.363	R38-532
1079	46.390409206	-84.793743683	276.543	R38-542
1080	46.390643928	-84.793591692	277.570	R38-552
1081	46.390850350	-84.793438794	277.390	R38-562
1082	46.391071264	-84.793350325	277.333	R38-572
1083	46.391262450	-84.793248003	277.565	R38-582
1084	46.389658639	-84.793659053	276.843	R38-b10
1085	46.389653581	-84.796257856	279.639	R38-b11

GCP measurement at Stand 40
May 22(Thursday) Raco area Day #4

Pnt #	Latitude	Longitude	Height	Code	
2025	46.391111836	-84.755114625	274.096	S40-T11	Stand 40
2026	46.390988736	-84.754577050	274.374	S40-T21	
2027	46.391564658	-84.754977950	272.450	S40-T23	
2028	46.391555519	-84.754448842	272.871	S40-T33	
2029	46.391556806	-84.753937856	272.918	S40-T43	
2030	46.391549497	-84.753373394	272.982	S40-T53	
2031	46.391648186	-84.752932339	273.744	S40-T63	
2032	46.391752728	-84.752380517	274.171	S40-T73	
2033	46.391781081	-84.751774747	274.685	S40-T83	
2034	46.391238889	-84.751523853	274.721	S40-T82	
2035	46.390324272	-84.751265589	274.390	S40-T81	
2036	46.390388747	-84.751728369	273.930	S40-T71	
2037	46.390575847	-84.752711903	273.748	S40-T61	
2038	46.390791981	-84.753706117	274.284	S40-T51	
2039	46.390976528	-84.754567169	274.471	S40-T41	

GCP measurement at Stand 45
May 23(Friday) Raco area Day #5

Pnt #	Latitude	Longitude	Height	Code
1000	46.4365839577	-84.9187931110	255.337	R45-11
1001	46.4366218777	-84.9184608646	255.601	R45-12
1002	46.4374355212	-84.9176143379	255.150	R45-13
1003	46.4372892501	-84.9174154600	254.983	R45-23
1004	46.4372894440	-84.9174157271	255.543	R45-23
1005	46.4369403120	-84.9171518857	255.732	R45-33
1006	46.4365483460	-84.9170620612	255.869	R45-32
1007	46.4365480911	-84.9175889154	255.826	R45-33
1008	46.4365978184	-84.9180329024	255.833	R45-34
1009	46.4366627572	-84.9183520006	255.699	R45-35
1010	46.4362817201	-84.9184352662	255.268	R45-41
1011	46.4360954328	-84.9180471209	255.561	R45-42
1012	46.4362133052	-84.9175049734	255.493	R45-43
1013	46.4362134354	-84.9175049825	255.487	R45-43
1014	46.4362293337	-84.9169745528	255.944	R45-44
1015	46.4360253642	-84.9170291355	255.799	R45-54
1016	46.4358002985	-84.9173617144	256.713	R45-53

GCP measurement at Stand 49
May 23(Friday) Raco area Day #5

Pnt # Latitude Longitude Height Code

2004,46.4309067575,-84.9012592083,257.559,S49-BASE1
2005,46.4303569257,-84.9017260754,259.287,S49-BASE2
2006,46.4305381461,-84.9011065354,259.541,S49-T11
2007,46.4303660329,-84.9010633171,258.197,S49-T12
2009,46.4300308731,-84.9009847520,259.731,S49-T23
2010,46.4298352713,-84.9011805030,261.339,S49-T24
2011,46.4297100957,-84.9011904800,262.448,S49-T25
2012,46.4296476971,-84.9012287543,263.229,S49-T35
2013,46.4295384146,-84.9013181699,263.618,S49-T45
2014,46.4296505475,-84.9014200266,263.711,S49-T46
2015,46.4297327994,-84.9013710273,262.966,S49-T35
2016,46.4297933404,-84.9014471757,262.133,S49-T36
2017,46.4299891044,-84.9016304519,261.663,S49-T34
2018,46.4300136680,-84.9017078434,261.811,S49-T33
2019,46.4300791292,-84.9017117465,260.945,S49-T32
2020,46.4301459191,-84.9017549974,260.450,S49-T331
2021,46.4302067742,-84.9017837576,260.139,S49-T31
2022,46.4300712672,-84.9020575414,261.314,S49-T3ROAD
2023,46.4297600451,-84.9022895670,263.478,S49-T41
2024,46.4296037331,-84.9022320765,263.931,S49-T42
2025,46.4296432952,-84.9019489311,263.854,S49-T43
2026,46.4295179658,-84.9017728642,263.967,S49-T44

Remark) Point #2008 is excluded because of incorrect measurement.

GCP measurement at Stand 50
May 24(Saturday) Raco area Day #6

Pnt #	Latitude	Longitude	Height	Code	
2000	46.426453714	-84.900390139	268.155	S50-T1	Stand 50
2001	46.426775761	-84.899897294	266.754	S50-T12	
2002	46.427709986	-84.898846422	264.892	S50-T13	
2003	46.427754147	-84.898418281	264.534	S50-T23	
2004	46.425699444	-84.898554119	268.047	S50-R4	
2005	46.425727914	-84.899038236	268.416	S50-R4A	
2006	46.425772539	-84.899008414	268.635	S50-R4B	
2007	46.425977581	-84.899728903	267.909	S50-R3	

GCP measurement at Stand 54
May 21(Wed) Raco area Day #3

Pnt #	Latitude	Longitude	Height	Code
1001	46.385504494	-84.801439514	278.623	R54-512
1002	46.385503156	-84.801135367	278.403	R54-522
1003	46.385483736	-84.800846850	278.283	R54-532
1004	46.385526697	-84.800592911	278.335	R54-542
1005	46.385560511	-84.800309789	278.485	R54-552
1006	46.385534781	-84.799935033	278.596	R54-562
1007	46.385575900	-84.799604081	277.816	R54-572
1008	46.385581953	-84.799320497	277.758	R54-582
1009	46.385997086	-84.799440678	277.891	R54-482
1010	46.386000525	-84.799716156	278.197	R54-472
1011	46.385976581	-84.799984422	278.171	R54-462
1012	46.385971439	-84.800298667	278.591	R54-452
1013	46.385934336	-84.800598531	278.632	R54-442
1014	46.385912131	-84.800856125	278.358	R54-432
1015	46.385869464	-84.801166189	278.731	R54-422
1016	46.385879886	-84.801516889	278.453	R54-412
1017	46.385150022	-84.801507142	278.407	R54-512
1018	46.385150239	-84.801249689	278.519	R54-522
1019	46.385162486	-84.800947769	278.182	R54-532
1020	46.385143875	-84.800654514	278.486	R54-542
1021	46.385132667	-84.800303267	278.728	R54-552
1022	46.385140600	-84.800032214	278.225	R54-562
1023	46.385147783	-84.799744192	278.376	R54-572
1024	46.385159828	-84.799412533	278.603	R54-582
1025	46.386210422	-84.801457542	278.818	R54-212
1026	46.386239714	-84.801160500	278.529	R54-222
1027	46.386231797	-84.800875278	278.539	R54-232
1028	46.386296067	-84.800557400	278.803	R54-242
1029	46.386335042	-84.800209319	278.276	R54-252
1030	46.386369461	-84.799964786	278.784	R54-262
1031	46.386380383	-84.799609989	278.452	R54-272
1032	46.386368272	-84.799263061	277.890	R54-282
1033	46.386697239	-84.799445269	278.516	R54-182
1034	46.386705694	-84.799765408	278.469	R54-172
1035	46.386682714	-84.800045892	278.264	R54-162
1036	46.386645822	-84.800314056	277.676	R54-152
1037	46.386656178	-84.800673644	277.277	R54-142
1038	46.386621808	-84.800960789	278.008	R54-132
1039	46.386511114	-84.801369583	277.762	R54-122
1040	46.386552322	-84.801523122	277.776	R54-112
1041	46.386618967	-84.801911567	277.683	R54-BL0
1042	46.384820889	-84.801858075	278.342	R54-BL1
1043	46.384820964	-84.801858122	277.836	R54-BL1

GCP measurement at Stand 55
May 22(Thursday) Raco area Day #4

Pnt #	Latitude	Longitude	Height	Code
1030	46.398455031	-84.795589928	281.691	R55-11
1031	46.398676514	-84.795176511	281.377	R55-12
1032	46.398904494	-84.794775864	281.526	R55-13
1033	46.399215561	-84.794534700	280.996	R55-14
1034	46.399607292	-84.794845378	280.100	R55-24
1035	46.399377392	-84.795316981	280.923	R55-23
1036	46.399239753	-84.795645567	281.301	R55-22
1037	46.399109081	-84.796099161	281.420	R55-21
1038	46.399294797	-84.796416011	281.740	R55-31
1039	46.399468872	-84.796112136	281.217	R55-32
1040	46.399741500	-84.795581458	281.090	R55-33
1041	46.399909403	-84.795213953	279.879	R55-34
1042	46.400113900	-84.795537344	280.331	R55-44
1043	46.399919100	-84.795876806	281.364	R55-43
1044	46.399730617	-84.796282606	281.571	R55-42
1045	46.399546383	-84.796595486	281.639	R55-41
1046	46.399702561	-84.796989983	281.992	R55-51

GCP measurement at Stand 56
May 20(Tue) Raco area Day #2

Pnt #	Latitude	Longitude	Height	Code
1047	46.381754772	-84.801591100	276.520	R56-112
1048	46.381727869	-84.801276542	275.765	R56-122
1049	46.381775167	-84.801019625	275.205	R56-132
1050	46.381774139	-84.800695314	275.319	R56-142
1051	46.381820583	-84.800283914	277.078	R56-152
1052	46.381824156	-84.799756797	277.343	R56-172
1053	46.381817558	-84.799516517	277.346	R56-182
1054	46.381453267	-84.799394472	277.438	R56-128
1055	46.381447494	-84.799661258	277.330	R56-272
1056	46.381444344	-84.799979831	277.041	R56-262
1057	46.381487336	-84.800279100	276.761	R56-252
1058	46.381418861	-84.800599967	276.757	R56-242
1059	46.381402597	-84.800885431	276.709	R56-232
1060	46.381390578	-84.801252661	277.066	R56-222
1061	46.381399756	-84.801471064	277.307	R56-212
1062	46.381040956	-84.801323078	276.899	R56-312
1063	46.381069522	-84.800996819	276.936	R56-322
1064	46.381117000	-84.800802831	276.956	R56-332
1065	46.381095117	-84.800336811	277.131	R56-342
1066	46.381101233	-84.800076058	277.140	R56-352
1067	46.381084858	-84.799773853	277.180	R56-362
1068	46.381106006	-84.799424650	277.357	R56-372
1069	46.381110975	-84.799053322	277.710	R56-382
1070	46.380703642	-84.799381139	277.522	R56-482
1071	46.380688039	-84.799826900	277.263	R56-472
1072	46.380718872	-84.800131686	277.267	R56-462
1073	46.380698569	-84.800529686	277.323	R56-452
1074	46.380678775	-84.800708064	277.558	R56-42
1075	46.380660481	-84.801010111	277.259	R56-422
1076	46.380692603	-84.801297406	277.173	R56-422
1077	46.380716006	-84.801567478	277.321	R56-412
1078	46.380301953	-84.801541378	277.242	R56-512
1079	46.380306083	-84.801314550	277.083	R56-522
1081	46.380284794	-84.800649306	277.248	R56-542
1082	46.380322958	-84.800381447	277.271	R56-552
1083	46.380300125	-84.800170539	277.420	R56-562
1084	46.380268908	-84.799888894	277.099	R56-572
1085	46.380265614	-84.799541300	277.264	R56-582

GCP measurement at Stand 58
May 20(Tue) Raco area Day #2

Pnt #	Latitude	Longitude	Height	Code
1009	46.373175500	-84.770793531	275.514	S58INIT POINTA
1010	46.373175528	-84.770793528	275.495	S58INIT POINTB
1011	46.373207139	-84.771116314	275.252	S58-02
1012	46.373248633	-84.771399819	275.353	S58-03
1013	46.373656881	-84.770914731	275.952	S58-21
1014	46.373723114	-84.771218011	275.377	S58-22
1015	46.373811353	-84.771512831	275.507	S58-23
1016	46.373955225	-84.771633875	275.389	S58-24
1017	46.373891192	-84.771819656	275.171	S58-24
1018	46.374025064	-84.772070636	274.929	S58-25
1019	46.374125456	-84.772357878	274.152	S58-26
1020	46.374254747	-84.772626692	273.309	S58-27
1021	46.374341083	-84.770855900	275.193	S58-41
1022	46.374405289	-84.771090567	275.187	S58-42
1023	46.374537864	-84.771347869	274.912	S58-43
1024	46.374728978	-84.771534067	274.194	S58-44
1025	46.374911622	-84.771728556	273.218	S58-45
1026	46.375153150	-84.771707106	272.882	S58-R5
1027	46.375154547	-84.771377011	273.621	S58-R4
1028	46.375147022	-84.771048308	274.621	S58-R3
1029	46.375143825	-84.770715694	274.917	S58-R2

GCP measurement at Stand 59
May 20(Tue) Raco area Day #2

Pnt #	Latitude	Longitude	Height	Code
1006	46.367859906	-84.805234450	275.974	R59TEST
1007	46.367592900	-84.805231686	276.150	R59-112
1008	46.367382475	-84.805204844	275.971	R59-122
1009	46.367132597	-84.805103519	276.226	R59-132
1010	46.366978833	-84.804928961	275.749	R59-142
1011	46.366830272	-84.804683567	275.561	R59-152
1012	46.366711428	-84.804417706	275.486	R59-162
1013	46.366592236	-84.804147569	275.362	R59-172
1014	46.366569769	-84.803842072	275.480	R59-182
1015	46.366266639	-84.804098531	275.320	R59-282
1016	46.366438761	-84.804297275	275.381	R59-272
1017	46.366399100	-84.804613814	275.425	R59-262
1018	46.366451444	-84.804949319	275.555	R59-252
1019	46.366455650	-84.805261608	275.679	R59-242
1020	46.366452578	-84.805576981	276.019	R59-232
1021	46.366460256	-84.805899608	275.934	R59-222
1022	46.366428572	-84.806211783	276.098	R59-212
1023	46.366591547	-84.806216175	276.075	R59-362
1024	46.366652681	-84.806620786	276.082	R59-352
1025	46.366637300	-84.806959483	276.326	R59-342
1026	46.366679486	-84.807268811	276.459	R59-332
1027	46.366727250	-84.807577419	276.299	R59-322
1028	46.366768269	-84.807894933	276.352	R59-312
1029	46.367554586	-84.807303108	273.035	R59-512
1030	46.367380450	-84.806302281	275.736	R59-522
1031	46.366949694	-84.806265497	276.068	R59-532
1032	46.366742656	-84.806250047	275.976	R59-533
1033	46.366595133	-84.806218267	276.117	R59-542
1034	46.366392569	-84.806179744	276.069	R59-552
1035	46.366227781	-84.806186386	276.253	R59-562
1036	46.366012044	-84.806109253	276.195	R59-572
1037	46.365798122	-84.806025161	276.012	R59-582
1038	46.366019486	-84.804992633	275.695	R59-382
1039	46.366252017	-84.805136383	275.791	R59-372
1040	46.366452269	-84.805258064	275.652	R59-362
1041	46.366642639	-84.805354239	275.639	R59-352
1042	46.366894772	-84.805420578	275.465	R59-342
1043	46.367089233	-84.805370764	275.960	R59-332
1044	46.367307589	-84.805331878	275.841	R59-322
1045	46.367514544	-84.805241700	276.036	R59-312

GCP measurement at Stand 61
May 21(Wed) Raco area Day #3

Pnt #	Latitude	Longitude	Height	Code
2000	46.367813819	-84.812976461	276.940	S61-R1
2001	46.367538775	-84.813256864	277.033	S61-T11
2003	46.366957700	-84.813403606	277.028	S61-T13
2004	46.366959606	-84.813406689	277.034	S61-T13
2005	46.366164253	-84.813711631	277.565	S61-T15
2006	46.366169942	-84.814388119	277.213	S61-T15
2007	46.367847589	-84.813896900	277.483	S61-R2
2008	46.367845217	-84.814411350	277.629	S61-R3
2009	46.367859342	-84.814802392	277.833	S61-R4
2010	46.367850494	-84.815340022	278.125	S61-R5
2011	46.367411161	-84.815059242	277.611	S61-T42
2012	46.367157322	-84.815114481	277.333	S61-T52

GCP measurement at Stand 66
May 22(Thursday) Raco area Day #4

Pnt #	Latitude	Longitude	Height	Code
1002	46.382977881	-84.807120883	273.131	R66-11
1003	46.382977933	-84.807120892	273.635	R66-112
1004	46.383351053	-84.807208094	274.095	R66-12
1005	46.383802664	-84.807285931	273.528	R66-13
1006	46.384324011	-84.807254783	273.886	R66-14
1007	46.384126281	-84.807694833	273.190	R66-24
1008	46.383911286	-84.807682567	272.555	R66-23
1009	46.383667886	-84.807757156	272.101	R66-22.9
1010	46.383421642	-84.807834303	272.387	R66-22.3
1011	46.383188706	-84.807929464	272.695	R66-25
1012	46.382978575	-84.807938097	273.046	R66-26
1013	46.382792661	-84.807895261	272.503	R66-27
1014	46.382948294	-84.808358242	272.113	R66-41
1015	46.383137072	-84.808178281	272.584	R66-42
1016	46.383347686	-84.808017217	272.193	R66-43
1017	46.383554844	-84.807833181	272.358	R66-44
1018	46.383751947	-84.807661597	272.549	R66-45
1019	46.383922425	-84.807499028	273.542	R66-46
1020	46.384081192	-84.807387072	274.037	R66-47
1021	46.384262981	-84.807244036	273.978	R66-48
1022	46.384116369	-84.806909236	274.901	R66-38
1023	46.383932647	-84.807043806	274.192	R66-37
1024	46.383778628	-84.807175783	273.538	R66-36
1025	46.383595239	-84.807294456	273.327	R66-35
1026	46.383386392	-84.807483767	273.329	R66-34
1027	46.383195089	-84.807615903	273.154	R66-33
1028	46.383026636	-84.807744708	272.986	R66-32
1029	46.382845403	-84.807836383	272.552	R66-31

GCP measurement at Stand 67
May 19(Mon) Raco area Day #1

Pnt # Latitude Longitude Height Code

1001,46.3901153567,-84.8102929206,278.472,R67-122
1002,46.3903320207,-84.8102212677,279.217,R67-132
1003,46.3905563080,-84.8101885853,279.238,R67-142
1004,46.3907785626,-84.8102541785,279.241,R67-152
1005,46.3910944753,-84.8103553184,279.696,R67-162
1006,46.3913078929,-84.8104376751,279.095,R67-172
1007,46.3915762219,-84.8104398255,279.219,R67-182
1008,46.3917080041,-84.8099755002,280.514,R67-282
1009,46.3914887362,-84.8099043301,279.745,R67-272
1010,46.3912710794,-84.8098207622,279.936,R67-262
1011,46.3909702621,-84.8097178568,281.017,R67-252
1012,46.3905140327,-84.8098087827,279.603,R67-242
1013,46.3902935312,-84.8098721003,279.640,R67-232
1014,46.3900423730,-84.8098969017,279.033,R67-222
1015,46.3898230162,-84.8098215379,278.831,R67-212
1016,46.3897977728,-84.8093393276,278.973,R67-312
1017,46.3900217497,-84.8093710389,279.341,R67-322
1018,46.3902453046,-84.8093827462,279.783,R67-332
1019,46.3905503042,-84.8093388985,280.496,R67-342
1020,46.3907776197,-84.8092989739,280.324,R67-352
1021,46.3909922274,-84.8092192219,279.618,R67-362
1022,46.3912179216,-84.8091899876,279.160,R67-372
1023,46.3914723283,-84.8091766301,279.449,R67-382
1024,46.3914269833,-84.8086793304,279.182,R67-482
1025,46.3912050421,-84.8087161767,278.690,R67-472
1026,46.3909750806,-84.8087802228,279.071,R67-462
1027,46.3906693470,-84.8087550522,280.309,R67-452
1028,46.3903209758,-84.8087292940,280.636,R67-442
1029,46.3900917064,-84.8087105046,279.835,R67-432
1030,46.3898614454,-84.8086914054,280.072,R67-422
1031,46.3900171706,-84.8082189129,280.365,R67-512
1032,46.3901973896,-84.8082417540,280.423,R67-522
1033,46.3904010544,-84.8082495966,280.007,R67-532
1034,46.3905863191,-84.8082545052,279.435,R67-542
1035,46.3908177930,-84.8082667713,278.632,R67-552
1036,46.3910184144,-84.8082729834,278.514,R67-562
1037,46.3911883484,-84.8082880742,279.009,R67-572
1038,46.3914748533,-84.8082972707,279.624,R67-582
1039,46.3895566138,-84.8081602981,278.969,R67-ROAD-5
1040,46.3895728339,-84.8102629235,277.436,R67-ROAD-1

GCP measurement at Stand 68
May 21(Wed) Raco area Day #3

Pnt #	Latitude	Longitude	Height	Code
2014	46.367783572	-84.786611078	273.305	S68-R1
2015	46.367791731	-84.786089939	273.340	S68-R2
2016	46.367798503	-84.785581544	273.161	S68-R3
2017	46.367803117	-84.785068611	273.929	S68-R4
2018	46.367798425	-84.784539567	273.677	S68-R5
2019	46.368418719	-84.784632419	274.303	S68-T51
2020	46.368414850	-84.784629156	273.282	S68-T51
2021	46.369071008	-84.784691983	273.143	S68-T52
2022	46.369512683	-84.784717133	274.117	S68-T53
2023	46.369277558	-84.784869981	272.761	S68-T54
2025	46.369436500	-84.786126814	273.654	S68-T45
2026	46.369444392	-84.786620183	273.580	S68-T35
2027	46.369376408	-84.787182458	274.931	S68-T25
2028	46.368768047	-84.787050372	275.052	S68-T32
2029	46.368676894	-84.786991508	272.730	S68-T31
2030	46.368651675	-84.786410053	273.519	S68-T21
2031	46.368747019	-84.785859956	272.979	S68-T22
2032	46.368739253	-84.785120672	273.047	S68-T23

GCP measurement at Stand 69
May 22(Thursday) Raco area Day #4
Pnt # Latitude Longitude Height Code
1047,46.4048937315,-84.7386432491,271.272,R69-11
1048,46.4049365707,-84.7383223638,271.287,R69-12
1049,46.4047676075,-84.7379993578,271.927,R69-13

GCP measurement at Stand 71
May 22(Thursday) Raco area Day #4

Pnt #	Latitude	Longitude	Height	Code
2001	46.390223167	-84.765548475	274.429	S71-T11
2002	46.390194797	-84.765147622	272.827	S71-T21
2003	46.390215258	-84.764702297	272.162	S71-T31
2004	46.390183361	-84.763911497	272.069	S71-T41
2005	46.390283386	-84.763241019	273.058	S71-T51
2007	46.390746569	-84.763620067	272.409	S71-T52
2008	46.390911217	-84.765158344	272.135	S71-T22
2009	46.390762506	-84.766047581	275.468	S71-T12
2010	46.391341567	-84.766071275	274.738	S71-T13
2011	46.391439022	-84.765572256	272.299	S71-T23
2012	46.391597147	-84.763916400	272.245	S71-T53

GCP measurement at Stand 72
May 22(Thursday) Raco area Day #4

Pnt #	Latitude	Longitude	Height	Code
2013	46.389923261	-84.762884100	273.479	S72-T11
2014	46.389964342	-84.762104206	273.053	S72-T31
2015	46.389974114	-84.761145825	272.680	S72-T51
2016	46.390406753	-84.761218017	275.077	S72-T52
2017	46.390316242	-84.762203517	274.749	S72-T22
2018	46.390694903	-84.762436144	274.913	S72-T23
2019	46.391101447	-84.762864014	272.734	S72-T24
2020	46.391200369	-84.761974664	272.160	S72-T34
2021	46.391426872	-84.760631175	273.924	S72-T44
2022	46.391803644	-84.760716350	271.040	S72-T45
2023	46.392210481	-84.760845792	272.423	S72-T46
2024	46.392194483	-84.761957697	272.435	S72-T26

GCP measurement at Stand 80
May 21(Wed) Raco area Day #3

Pnt #	Latitude	Longitude	Height	Code
1086	46.340864353	-84.905768011	278.491	R80-11
1087	46.340898856	-84.906358378	277.688	R80-12
1088	46.340901892	-84.906962819	277.804	R80-13
1089	46.340962608	-84.907612953	277.756	R80-14
1090	46.340600489	-84.907754861	278.331	R80-24
1091	46.340570142	-84.907307519	278.925	R80-23
1092	46.340560278	-84.906891783	278.904	R80-22
1093	46.340523606	-84.906372950	279.138	R80-21
1094	46.340255472	-84.906200339	279.267	R80-31
1095	46.340279442	-84.906699783	279.324	R80-32
1096	46.340322158	-84.907171717	279.122	R80-33
1097	46.340348314	-84.907703256	278.778	R80-34
1098	46.339919667	-84.907718475	279.028	R80-44
1099	46.339957861	-84.907255611	279.110	R80-43
1100	46.340021633	-84.906807128	279.471	R80-42
1101	46.340051022	-84.906184628	279.336	R80-41

GCP measurement at Stand 85
May 24(Saturday) Raco area Day #6
Pnt # Latitude Longitude Height Code
1007,46.3942790996,-84.9706821837,278.604,R85-1

Appendix C: Brief Description of Stands

Appendix C consists of three parts.

(1) The location and description of each stand ..... Page C-3 – C-7
The information is based on the following reference.

Reference)
"Structure, Composition, and Above-ground Biomass of SIR-C/X-SAR and ERS-1 Forest Test Stands 1991-1994, Raco Michigan Site"
Kathleen M.Bergen, M.Craig Dobson, Terry L.Sharik, Ian Brodie
October 30,1995
Report 026511-7-T

(2) 3 dimensional plots of each stand .....Page C-8 – C-30
Each measured datum is plotted three dimensionally.

(3) The brief sketches of some stands .....Page C-31 – C-39
During the measurement, sketches were made in some stands, not all of the stands.

Stand 22 (D)--Red pine--sapling (C55-S35)

Raco Airfield, NW corner. Entrance to airport is south off M-28, 0.1 mi. west of Rt. 3157. Baseline starts 30 m. down from NW corner of airfield and runs along stand edge on azimuth of 155 deg. Transect #1 begins at m. 30 on the baseline and runs on 110 deg. azimuth. Sample points begin a minimum of 20 m. from the baseline (plantation edge), except for transect #5 where the minimum was 30 m. Location of the first sample point on the transects is 19, 23, 4, 6, and 9 m. beyond the minimum distance, respectively.

Stand 31 (Q)--Northern hardwoods--pole (C20-S8)

W side of Rt. 3159, 0.2 mi. N of Rt. 3156. Baseline runs along stand edge on az of 180 deg. Transect #1 starts at m. 19 along the baseline and runs on az of 90 deg, with first sample point a min. of 30 m. from the edge. Location of the first sample point on the transects is 1, 24, 3, 22, and 21 m. beyond the minimum distance, respectively.

Stand 33 (S)--Aspen--sapling (C20-S10)**

On Rt. 3156, 0.15 mi. W of intersection with Rt. 3159. Original baseline ran along stand edge on az. of 115 deg for a distance of 320 m. Transect #1 started at m. 14 along baseline on an az. of 0 deg.; first sample point was a min. of 20 m. from the edge. There were 8 transects with 5 sample points per transect. Due to stand irregularities, transects 9 and 10 were added (with 4 points per transect) to the west of transect #1 to compensate for missing plots on Transects 6, 7, and 8, which now contain 1, 2, and 4 points, respectively. Transect #9 starts 33 m. W of a logging trail which runs on an az of 20 deg. Location of the first sample point is 22, 15, 18, 13, 20, 19, 10, 16, 17, and 1 m. beyond the minimum distance for transects 1-10 respectively.

Stand 34 (T)--Aspen--mature (C19-S24)**

On N side of Rd. opposite Stand S, starting 75 m. W of intersection with Rt. 3161. Baseline runs along stand edge on az. of 295 deg. Transect #1 starts at m. 39 on the baseline and runs on an az of 205 deg; first sample point is a minimum of 30 m. from the edge. Transect #5 has only 5 points because of space constraints. Location of the first sample point on the transects is 7, 13, 8, 16, and 6 m. beyond the minimum distance, respectively.

Stand 38 (X)--Jack pine--sapling (C31-S50)

On Rt. 3036, 0.25 mi. E of junction with Rt. 3018. Baseline runs along the N side of Rt. 3036, on az. of 90 deg.; m. 200 on the baseline is 61.8 m. W of the E edge of the stand. Transect #1 starts at m. 5 along the baseline and runs on an az. of 20 deg.; first sample point is min. of 10 m. from the baseline. Location of first sample point on the transects is 5, 16, 3, 13, and 7 m. beyond the minimum distance, respectively.

Stand 40 (Z)--Red pine--sapling (C29-R18)**

On Rt. 3366, 0.25 mi. E of junction with Rt. 3041. Baseline runs along the N side of Rt. 3366 for a distance of 440 m, on az. of 120 deg.; baseline starts 38 m. E of W edge of stand, while m. 440 on baseline is 42 m. W of E end of stand. There are 9 transects along the baseline, with a variable number of sample points per transect to accommodate the irregular shape of the stand. The number of points are 3, 2, 3, 3, 6, 7, 7, 6, and 3 respectively. Transect #1 starts at m. 38 along the baseline and runs on an az. of 30 deg.; first sample point is a min. of 10 m. from the baseline. Location of first sample point on the transects is 22, 11, 10, 21, 23, 1, 23, 6, 22, 9, and 22 m. beyond the minimum distance, respectively.

Stand 45 (EE)--Aspen--sapling (C20-R30)

Take Rt. 3156 0.9 mi. NW of junction with Rt. 3159, turn right (NE) onto spur road for 75 m. to W-central edge of stand. Baseline starts 20 m. in from spur road and runs along the edge of the stand on an az. of 152 deg. Transect #1 begins at m. 9 on the baseline and runs on an az. of 36 deg.; first sample point is a minimum of 30 m. from the baseline. Location of first sample point on the transects is 15, 8, 7, 10, and 17 m. beyond the minimum distance, respectively. Wire flags marking sample points are reversed, with yellow at the upper stratum plot center and red at the middle stratum plot centers. Rebars may be absent at the ends of the baseline. There are scattered individuals in the overstory which have not been removed as of 10-19-92 (ditto for 7/94).

Stand 49 (JJ)--Aspen--sapling (C21-S9 & 10)**

On Rt 3640, 0.3 mi. NE of junction with Rt. 3156. Baseline starts 40 m. from the NE corner of the stand and runs on an az. of approx. 230 deg. along the NW edge of the stand. Transect #1 begins at m. 36 on the baseline and runs on an az. of 100 deg.; first sample point is a minimum of 20 m. from the baseline. Due to size limitations, only 38 sample points were established along 5 transects, with 5, 6, 8, 10, and 9 sample points, respectively. Location of first sample point of the transects is 10, 4, 7 (17?), 3, and 9 m. beyond the minimum distance, respectively. On transect #5 a truck trail passes between sample points 3 and 4, thus moved point #4 20 m. down the transect.

Stand 50 (KK)--Red pine--mature (C21-S8)**

On Rt. 3156, 0.33 mi. SE of junction with Rt. 3159. Baseline starts 40 m. from W edge of stand and runs along N side of Rt. 3156, on an az. of 118 deg. Transect #1 begins at m. 9 on the baseline and runs on an az. of 360 deg.; first sample point is a min. of 20 m. from the baseline. Because of stand irregularities, transect #5 was skipped and a sixth transect added. The number of sample points per transect is 6, 8, 8, 9, and 9, respectively. Location of first sample point on the transects is 11, 1, 12, 16, and 3, respectively.

Stand 54--Jack pine--sapling (C31-S38)

On FS 3018, m. 0.0 is 0.3 mi. south of junction with FS 3036. Baseline runs along the east side of 3018, on an az. of 180 deg. Transect #1 begins at m. 7 on the baseline and runs on an az. of 87 deg. First sample point is a minimum of 20 m. from the baseline. Location of first sample point on the transects is 9, 15, 12, 15, and 6 m. beyond the minimum distance, respectively.

Stand 55--Jack pine--sapling (C31-S52)

On north side of FS 3366, a reference point is 0.3 mi. east of junction with FS 3018. From reference point, baseline m. 0.0 is 62.5 m. into the forest at an az. of 18 deg. Transect #1 begins at m. 36 on the baseline and runs on an az. of 288 deg. First sample point is a minimum of 0 m. from the baseline. Location of first sample point on the transects is 6, 25, 11, 3, and 5 m, respectively.

Stand 56--Jack Pine--pole (C31-S62)

On FS 3018, m. 0.0 is 40 m. south of junction with FS 3037. Baseline runs along the east side of FS 3018, on and az. of 180 deg. Transect #1 begins at m. 18 on the baseline and runs on an az. of 90 deg. First sample point is a minimum of 20 m. from the baseline. Location of first sample point on the transects is 3, 6, 22, 2, and 6 m. beyond the minimum distance, respectively.

Stand 58--Jack pine--sapling (C49-S33)

On FS 3040, m. 200 is 20 m. south of junction with FS 3364. Baseline runs along the west side of FS 3040, on an az. of 0 deg. Transect #1 begins at m. 11 on the baseline and runs on an az. of 270 deg. First sample point is a minimum of 20 m. from the baseline. Location of first sample point on the transects is 19, 24, 18, 9, and 18 m. beyond the minimum distance, respectively.

Stand 59--Jack pine--sapling (C48-S5)

On FS 3040, m. 200 is 0.2 mi. west of junction with FS 3018. Baseline runs along the south side of FS 3040, on an az. of 269 deg. Transect #1 begins at m. 30 on the baseline and runs on an az. of 180 deg. First sample point is a minimum of 20 m. from the baseline. Location of first sample point on the transects is 6, 20, 6, 17, and 22 m. beyond the minimum distance, respectively.

Stand 61--Jack pine--mature (C48-S13)

On FS 3040, m. 0.0 is 50 m. west of junction with FS 3039. Baseline runs along the south side of FS 3040, on an az. of 88 deg. Transect #1 begins at m. 24 on the baseline and runs on an az. of 180 deg. First sample point is a minimum of 30 m. from the baseline. Location of first sample point on the transects is 15, 6, 6, 22, and 2 m. beyond the minimum distance, respectively.

Stand 66--Jack pine--seedling (C32-S21)

On FS 3037, m. 160 is 0.2 mi. west of junction with FS 3018. Baseline runs along the north side of FS 3037, on an az. of 270 deg. Transect #1 begins at m. 29 on the baseline and runs on an az. of 36 deg. (Road crosses baseline at 50 m. mark.) First sample point is a minimum of 80 m. from the baseline. Location of first sample point on the transects is 13, 14, 2, and 25 m. beyond the minimum distance, respectively. The stand shape is irregular with 4 transects having 10 plots each.

Stand 67--Jack pine--mature (C32-S22)

On FS 3036, m. 200 is 0.3 mi. west of junction with FS 3018. Baseline runs along the north side of FS 3036, on an az. of 90 deg. Transect #1 begins at m. 24 on the baseline and runs on an az. of 0 deg. First sample point is a minimum of 30 m. from the baseline. Location of first sample point on the transects is 4, 8, 14, 8, and 22 m. beyond the minimum distance, respectively.

Stand 68--Red pine--pole (C49-S9)

On FS 3040, m. 0.0 is 0.8 mi. east of junction with FS 3018. Baseline runs along the north side of FS 3040, on an az. of 90 deg. Transect #1 begins at m. 29 on the baseline and runs on an az. of 355 deg. First sample point is a minimum of 50 m. from the baseline. Location of first sample point on the transects is 19, 14, 17, 15, and 22 m. beyond the minimum distance, respectively. A jack pine inclusion occurs at 125 m. on the baseline and goes in approx. 60 m.

Stand 69--Aspen (upland)--sapling (C23-S23)

On FS 3154, m. 200 is 0.1 mi. north of junction with FS 3622. Baseline runs along the east side of FS 3154, on an az. of 180 deg. Transect #1 begins at m. 23 on the baseline and runs on an az. of 90 deg. First sample point is a minimum of 20 m. from the baseline. Location of first sample point on the transects is 18, 11, 21, 5, and 12 m. beyond the minimum distance, respectively. 15 plots were measured in 1993. (T1 plots 1-5, T2 plots 1-4, T3 plots 1-3, T4 plots 4 & 6, T5 plot 5). Later reconfigured for GPS survey to be 8 transects (320 m.) by 5 plots ea. deep.

Stand 71--Red pine--pole (C30-S52)

On FS 3036, m. 200 is 220 m. west of junction with FS 3041. Baseline runs along the north side of FS 3036, on an az. of 90 deg. Transect #1 begins at m. 3 on the baseline and runs on an az. of 0 deg. First sample point is a minimum of 30 m. from the baseline. Location of first sample point on the transects is 12, 21, 9, 19, and 11 m. beyond the minimum distance, respectively.

Stand 72--Red pine--pole (C30-S52)

On FS 3036, m. 200 is 17.5 m. west of junction with FS 3041. Baseline runs along the north side of FS 3036, on an az. of 90 deg. Transect #1 begins at m. 9 on the baseline and runs on an az. of 0 deg. First sample point is a minimum of 30 m. from the baseline. Location of first sample point on the transects is 13, 15, 30, 4, and 2 m. beyond the minimum distance, respectively.

Stand 80--Red pine--seedling (C58-S39)

On FS 3139, m. 160 is 0.4 mi. south of junction with M-28. Baseline runs along the west side of FS 3139, on an az. of 0 deg. Transect #1 begins at m. 28 on the baseline and runs on an az. of 260 deg. First sample point is a minimum of 65 m. from the baseline. Location of first sample point on the transects is 3, 25, 24, and 5 m. beyond the minimum distance, respectively. The stand shape is irregular having 4 transects with 10 plots each.

Stand 85--Northern hardwoods--pole (C44-S19)

On trail to Peck and Rye Lake, m. 0.0 is 0.3 mi. north of junction with FS 3162. Baseline runs along the west side of the trail to Peck and Rye lake, on an az. of 360 deg. Transect #1 begins at m. 31 on the baseline and runs on an az. of 270 deg. First sample point is a minimum of 20 m. from the baseline. Location of first sample point on the transects is 14, 5, 12, 1, and 8 m. beyond the minimum distance, respectively.

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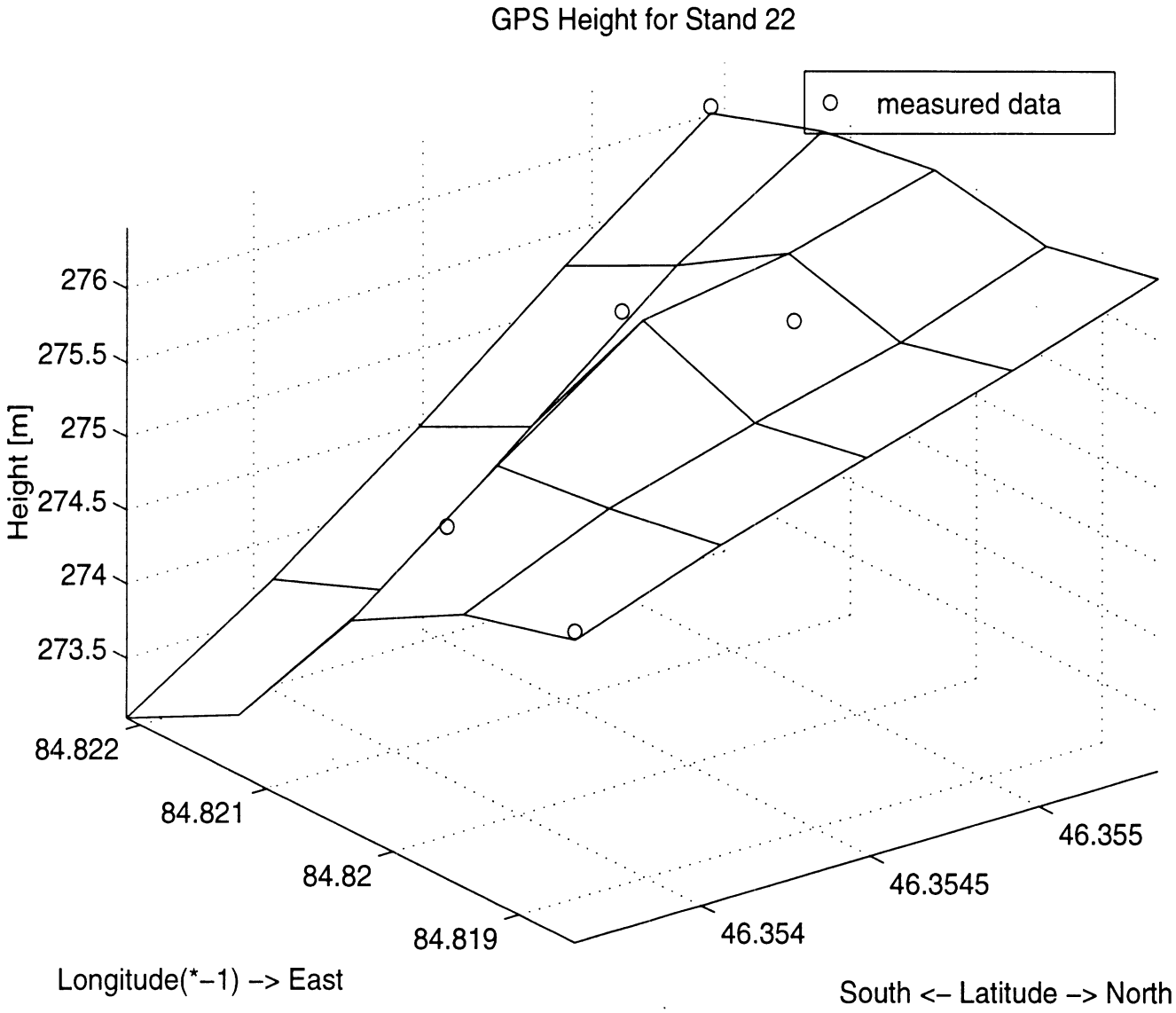
*All baselines are 200 m. long with 5 transects situated along them and with 8 sample points per transect, unless otherwise indicated. Sample points on a transect are at intervals of 25 m, with the first point located at a random distance of 1-25 m. from the baseline or from the "minimum distance from the baseline", depending on the stand. White wire flags mark locations of transects on the baseline, while red and yellow flags mark the centers of the upper- and middle-stratum plot centers, respectively , unless otherwise noted. Magnetic declination is 5 deg. W.

**Some irregularities in plot layout or homogeneity of vegetation, topography, and/or soil conditions


GPS Height for Stand 22
measured data
Height [m]
276
275.5
275
274.5
274
273.5
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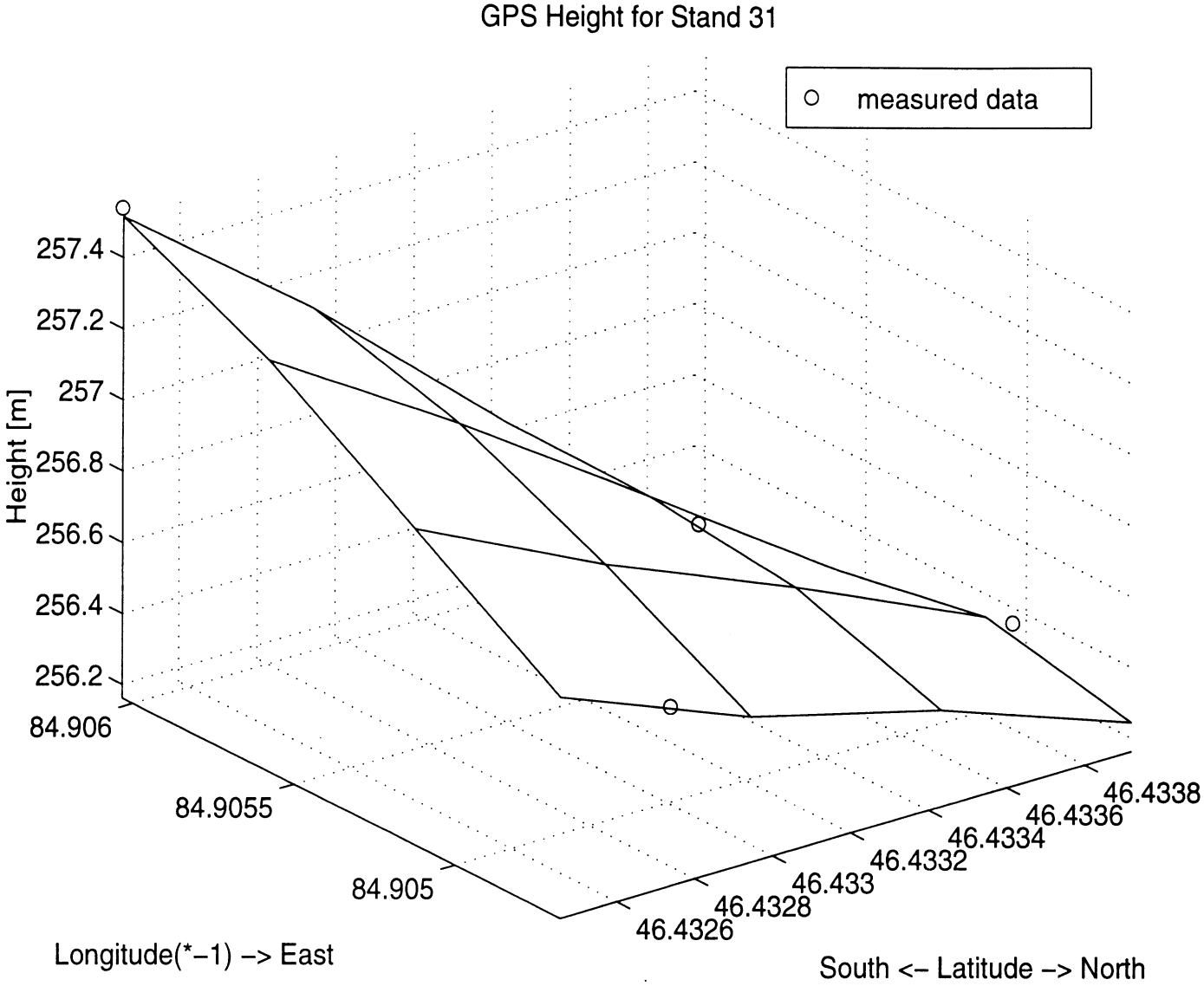
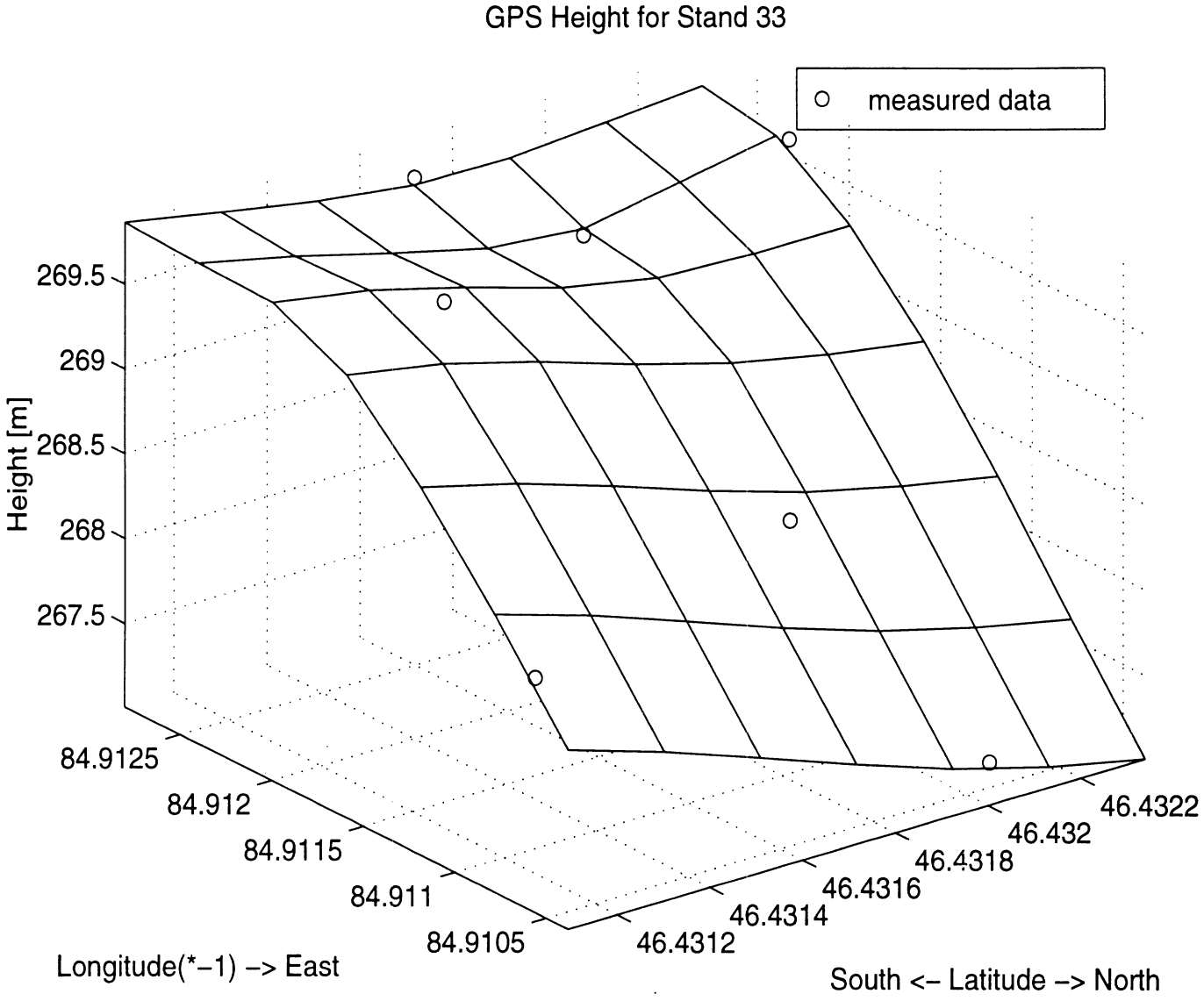
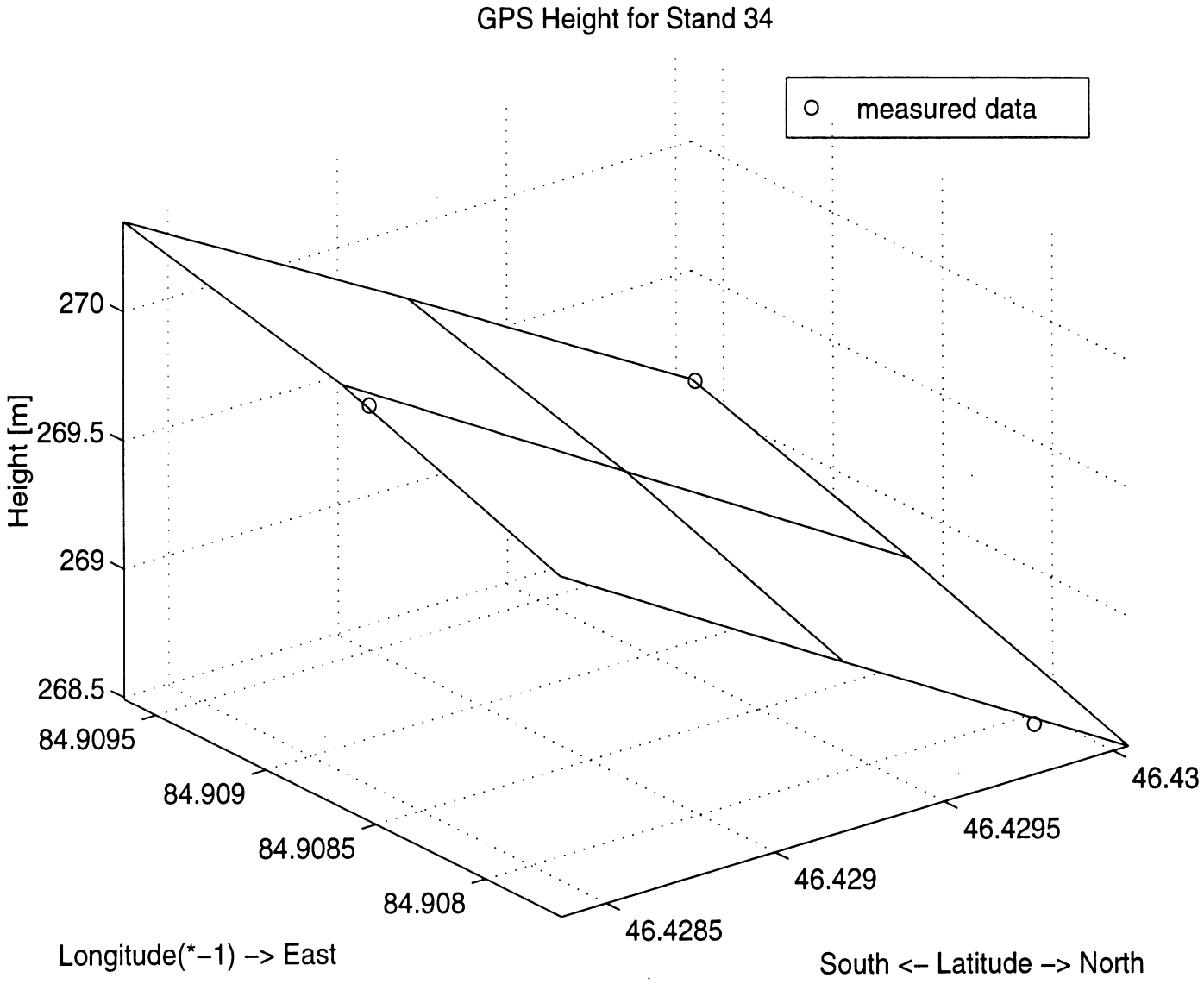
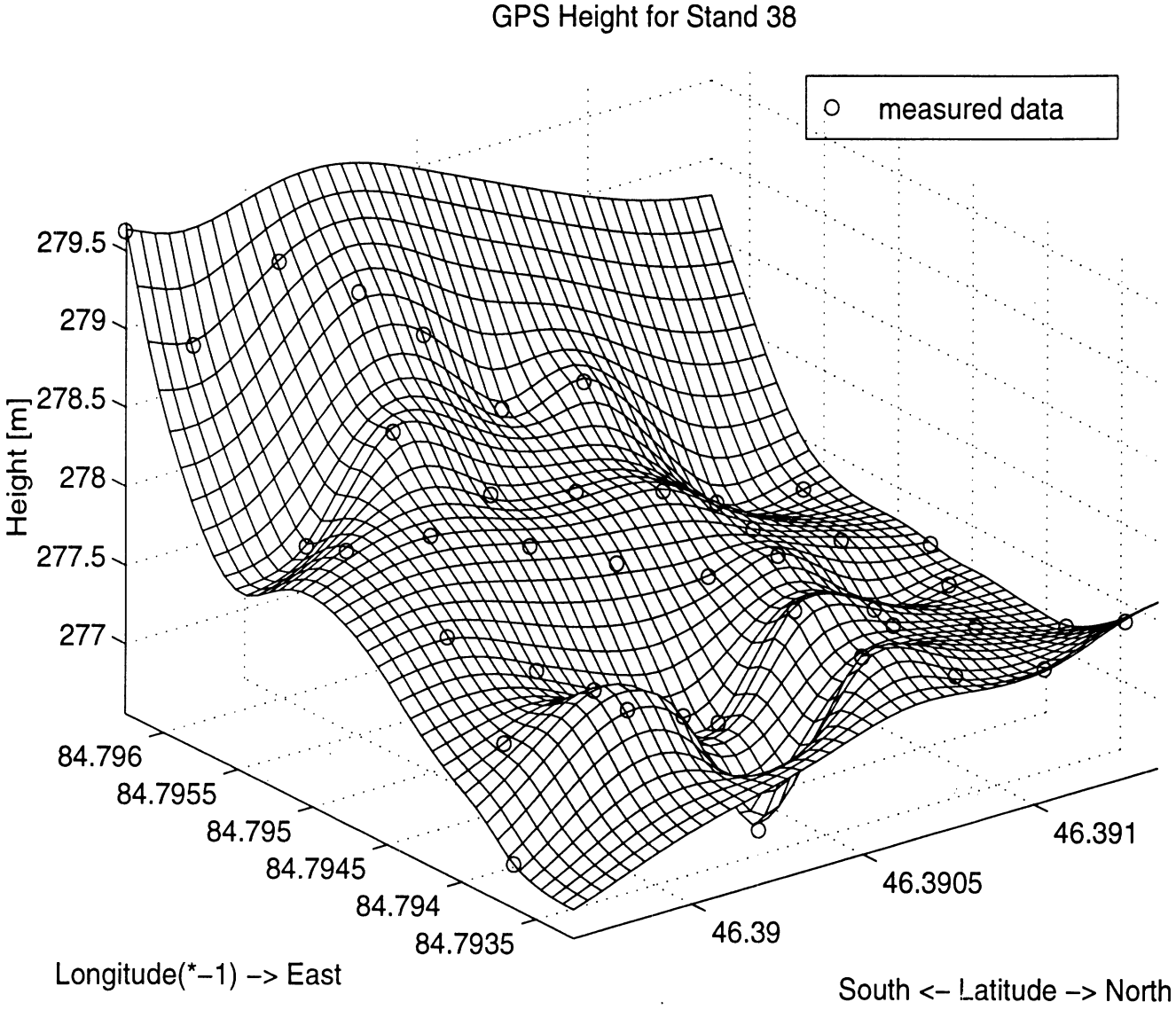
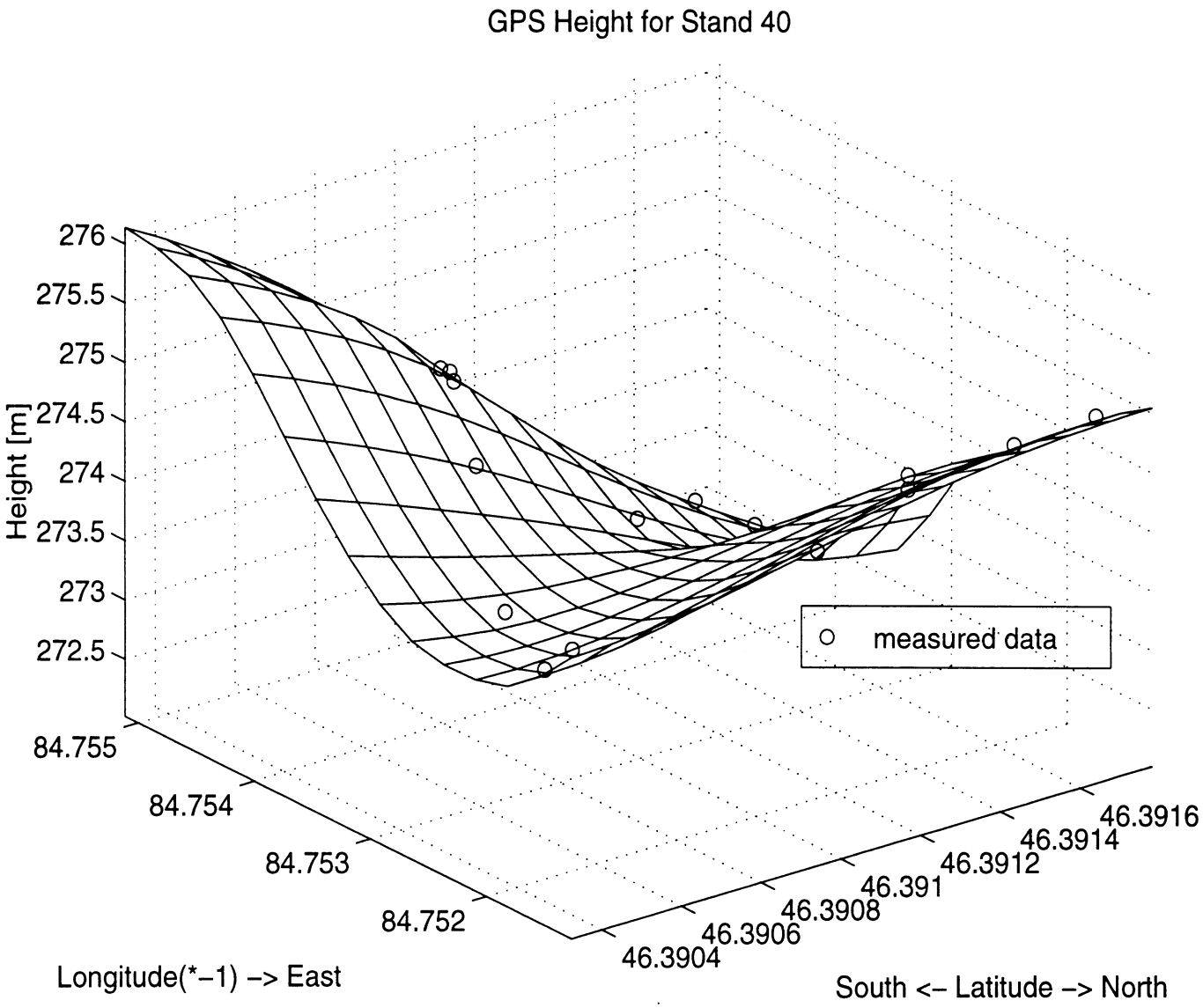
84.82
84.819
Longitude(*−1) -> East
46.355
46.3545
46.354
South <- Latitude -> North

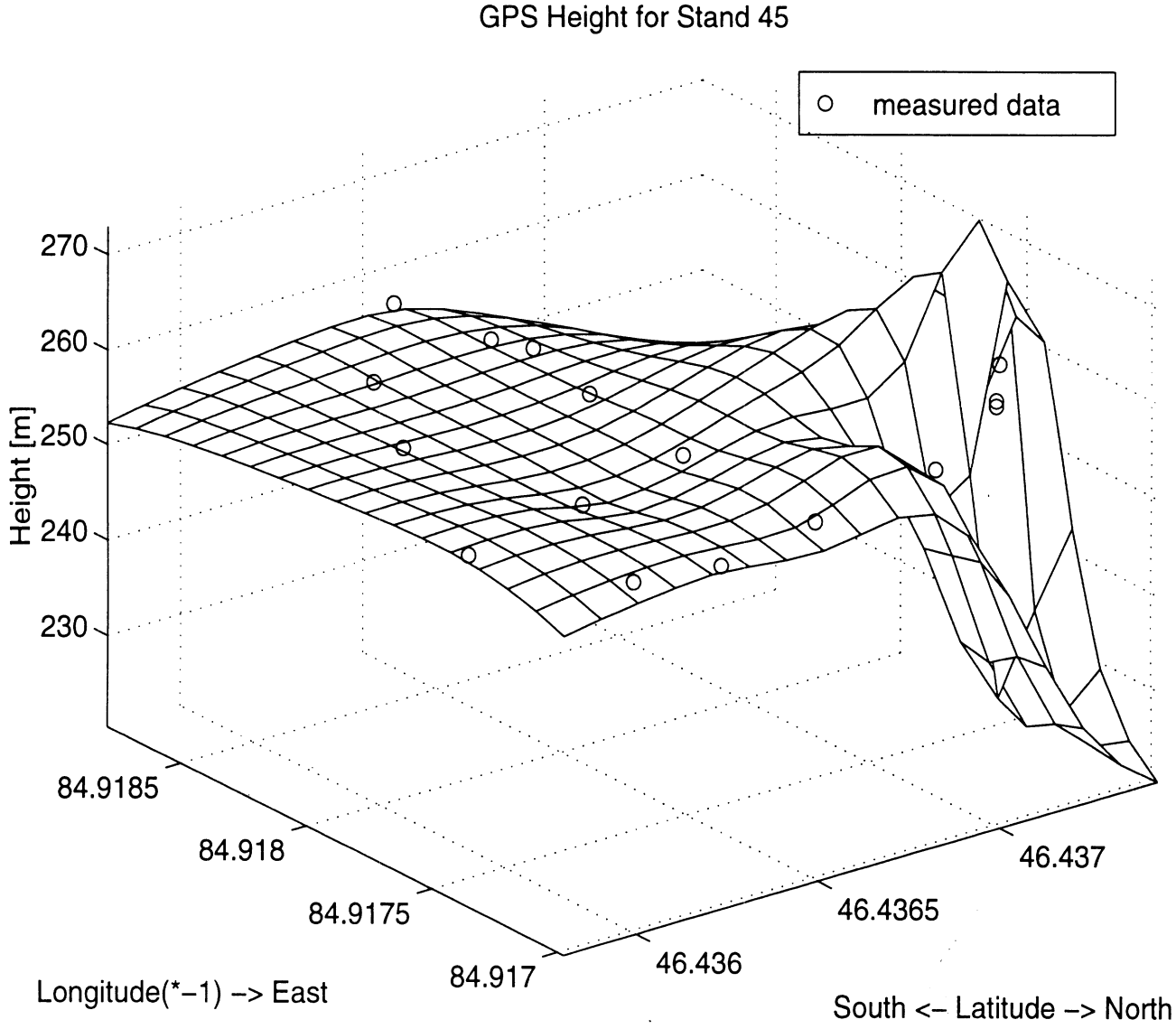

GPS Height for Stand 31
measured data
Height [m]
257.4
257.2
257
256.8
256.6
256.4
256.2
84.906
84.9055
84.905
Longitude(*−1) -> East
46.4326
46.4328
46.433
46.4332
46.4334
46.4336
46.4338
South <- Latitude -> North

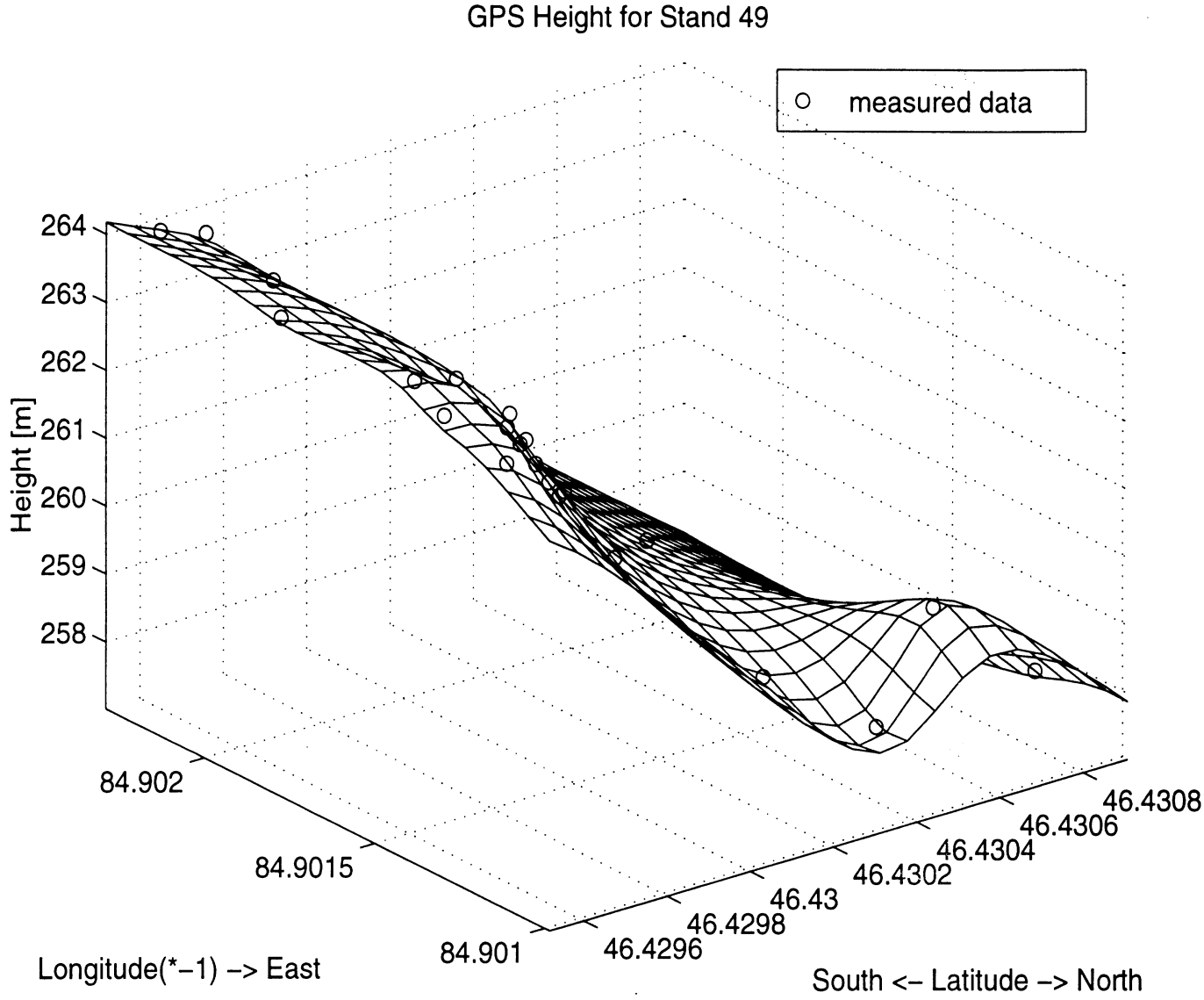

GPS Height for Stand 33
measured data
Height [m]
269.5
269
268.5
268
267.5
84.9125
84.912
84.9115
84.911
84.9105
Longitude(*−1) -> East
46.4312
46.4314
46.4316
46.4318
46.432
46.4322
South <- Latitude -> North

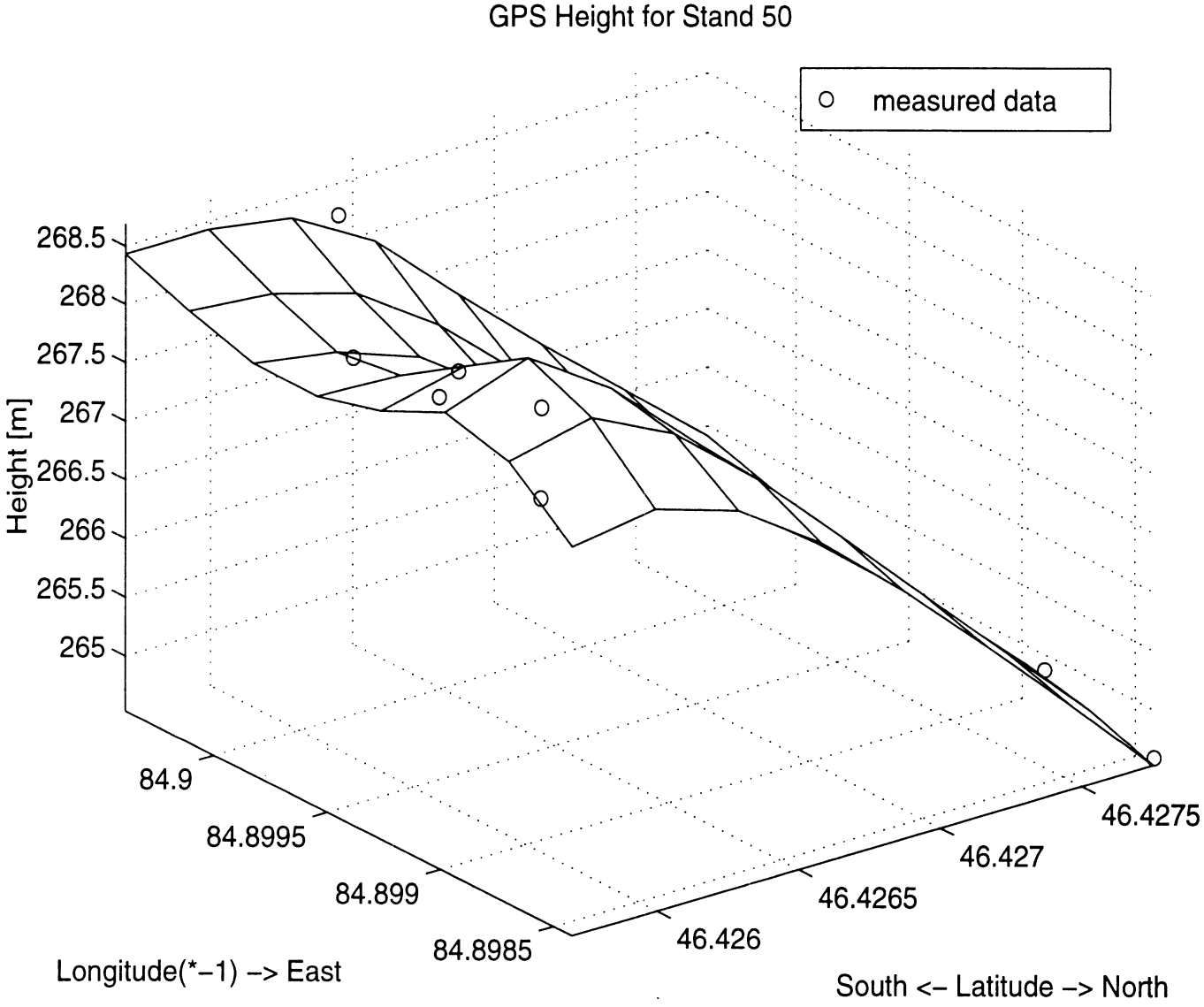

GPS Height for Stand 34
measured data
Height [m]
270
269.5
269
268.5
84.9095
84.909
84.9085
84.908
Longitude(*−1) -> East
46.4285
46.429
46.4295
46.43
South <- Latitude -> North

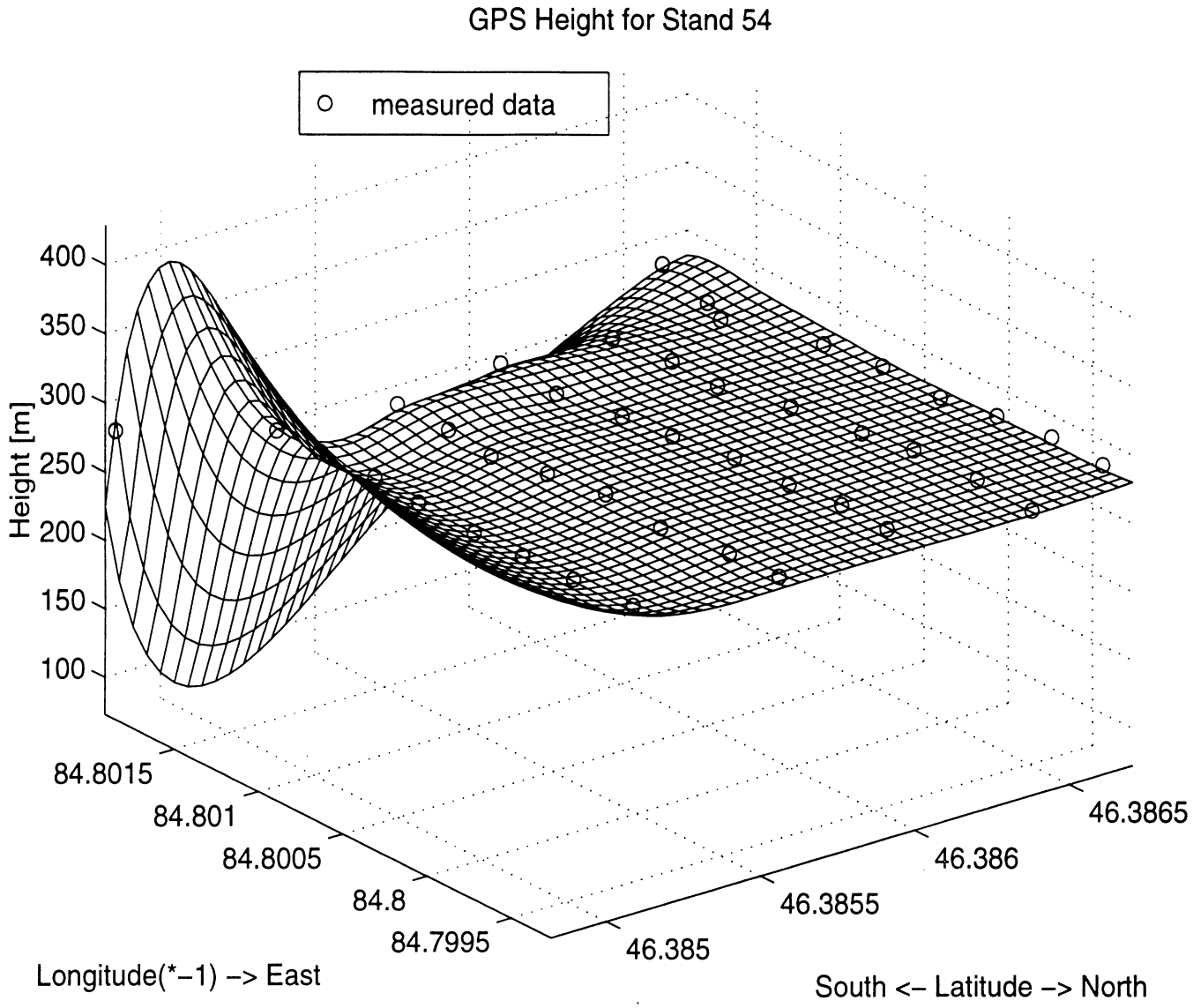

GPS Height for Stand 38
measured data
279.5
279
278.5
278
277.5
277
Height [m]
84.796
84.7955
84.795
84.7945
84.794
84.7935
Longitude(*−1) -> East
46.39
46.3905
46.391
South <- Latitude -> North

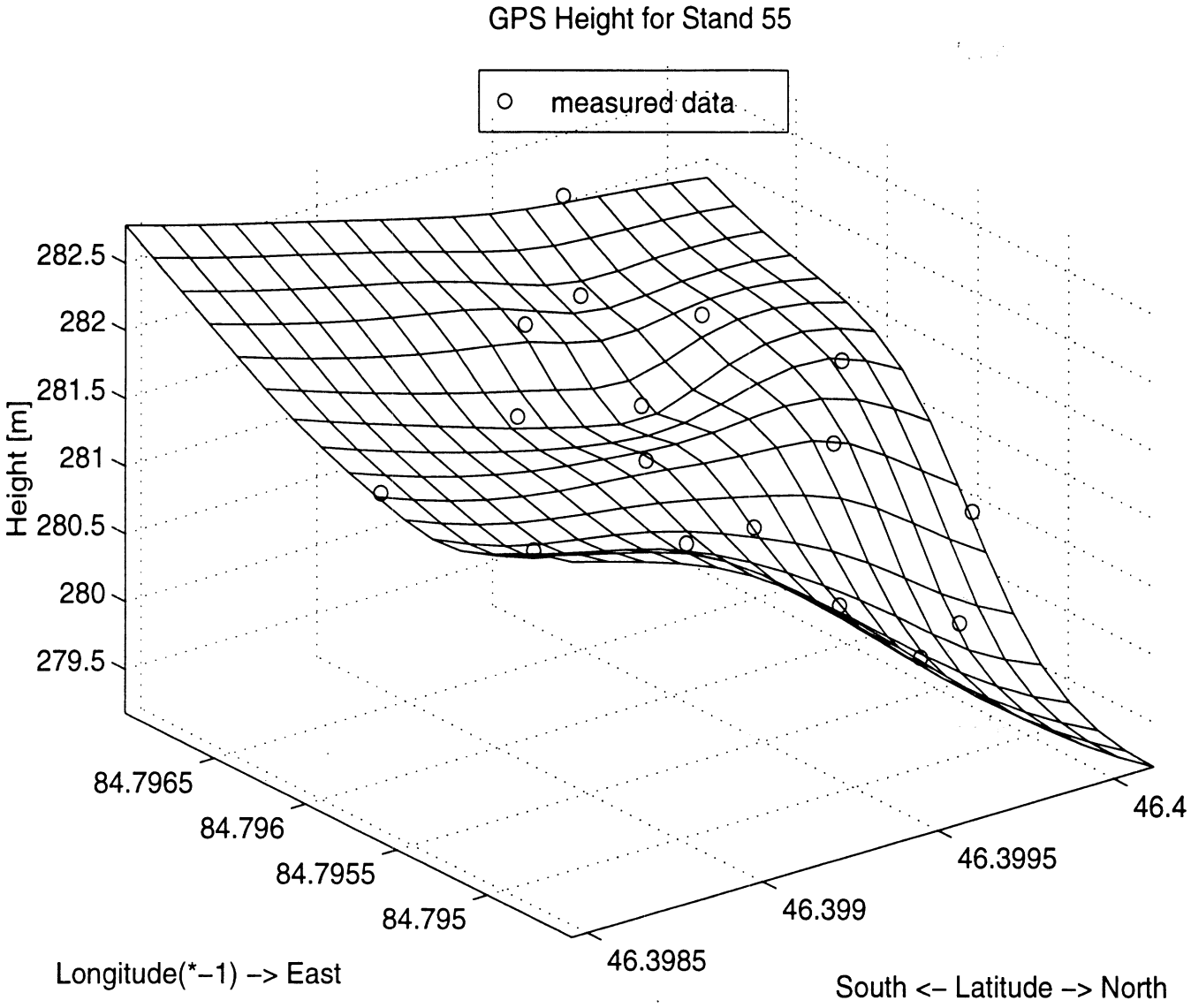

GPS Height for Stand 40
Height [m]
276
275.5
275
274.5
274
273.5
273
272.5
84.755
84.754
84.753
84.752
Longitude(*−1) -> East
46.3904
46.3906
46.3908
46.391
46.3912
46.3914
46.3916
South <- Latitude -> North
measured data

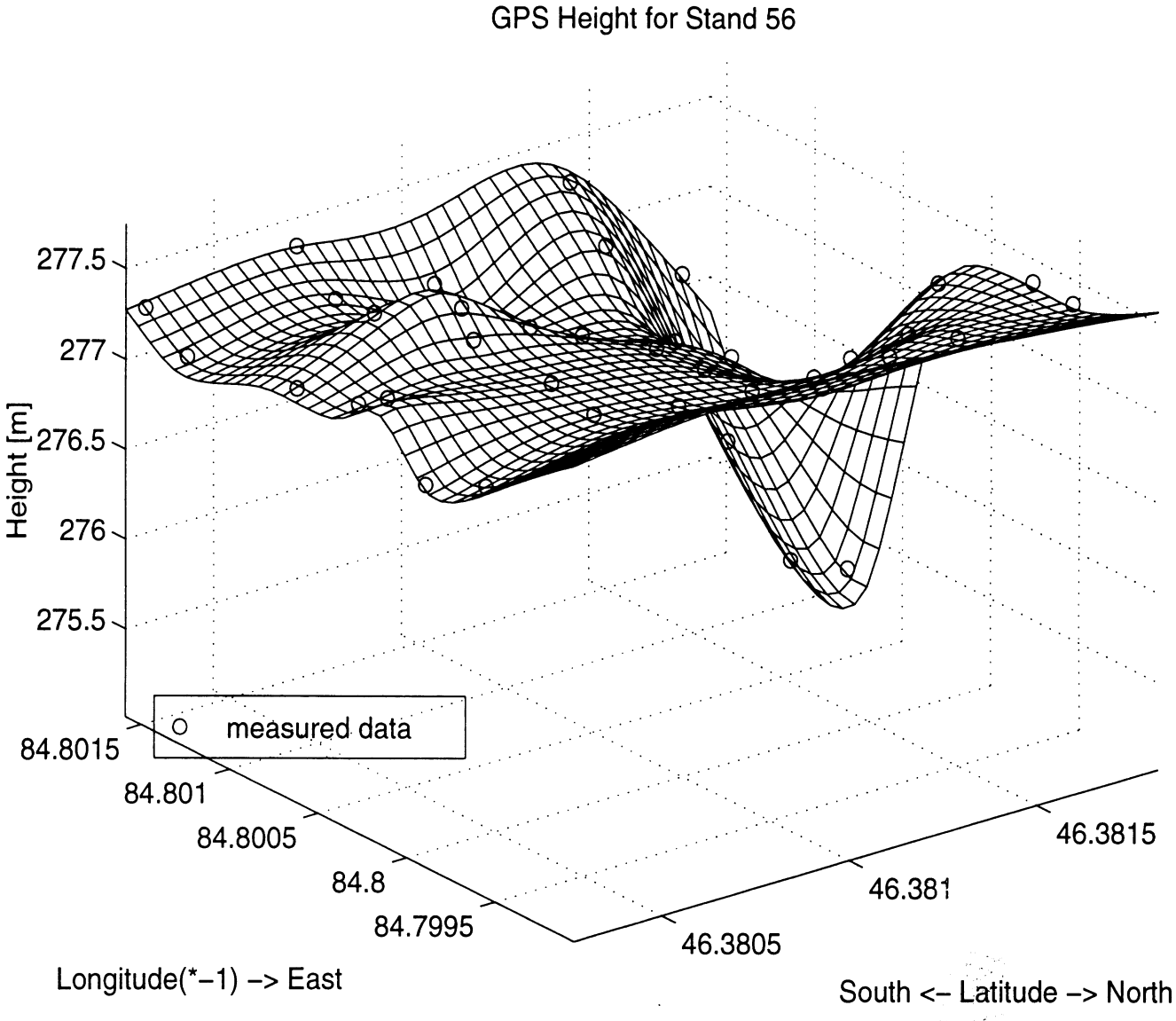

GPS Height for Stand 45
measured data
270
260
250
240
230
Height [m]
84.9185
84.918
84.9175
84.917
Longitude(*−1) -> East
46.436
46.4365
46.437
South <- Latitude -> North

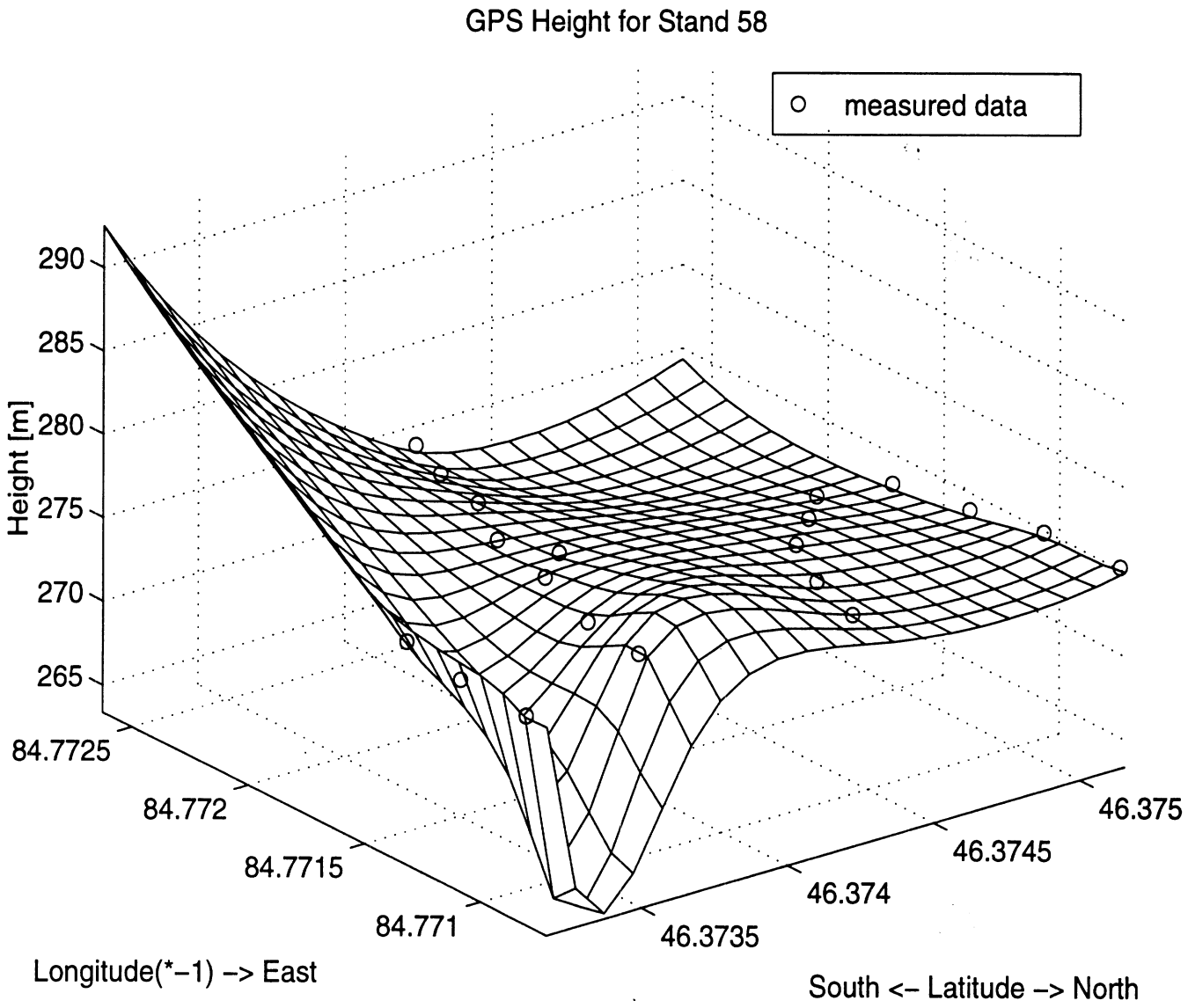

GPS Height for Stand 49
measured data
Height [m]
264
263
262
261
260
259
258
84.902
84.9015
84.901
Longitude(*−1) -> East
46.4296
46.4298
46.43
46.4302
46.4304
46.4306
46.4308
South <- Latitude -> North

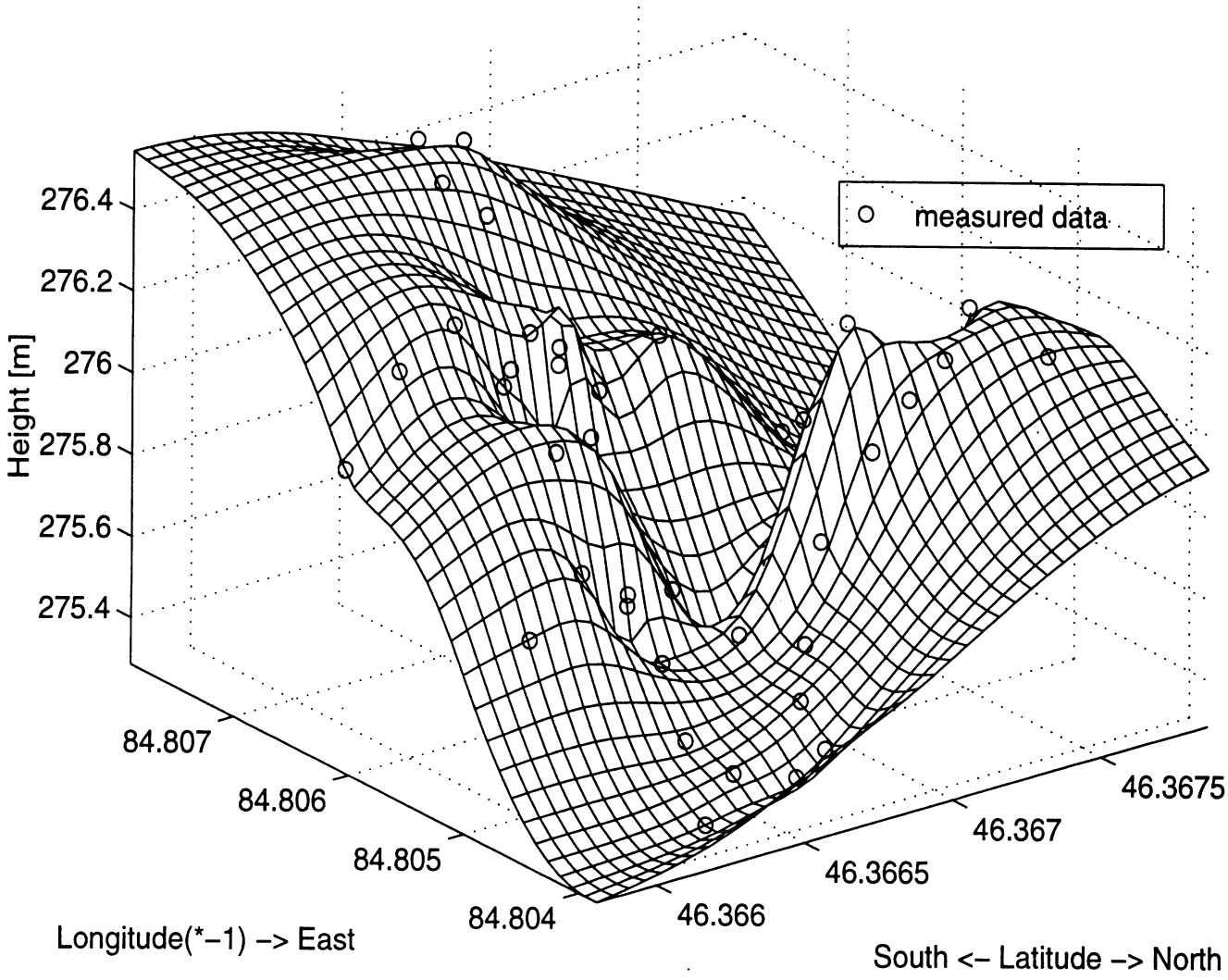

GPS Height for Stand 50
measured data
Height [m]
268.5
268
267.5
267
266.5
266
265.5
265
84.9
84.8995
84.899
84.8985
Longitude(*−1) -> East
46.4275
46.427
46.4265
46.426
South <- Latitude -> North

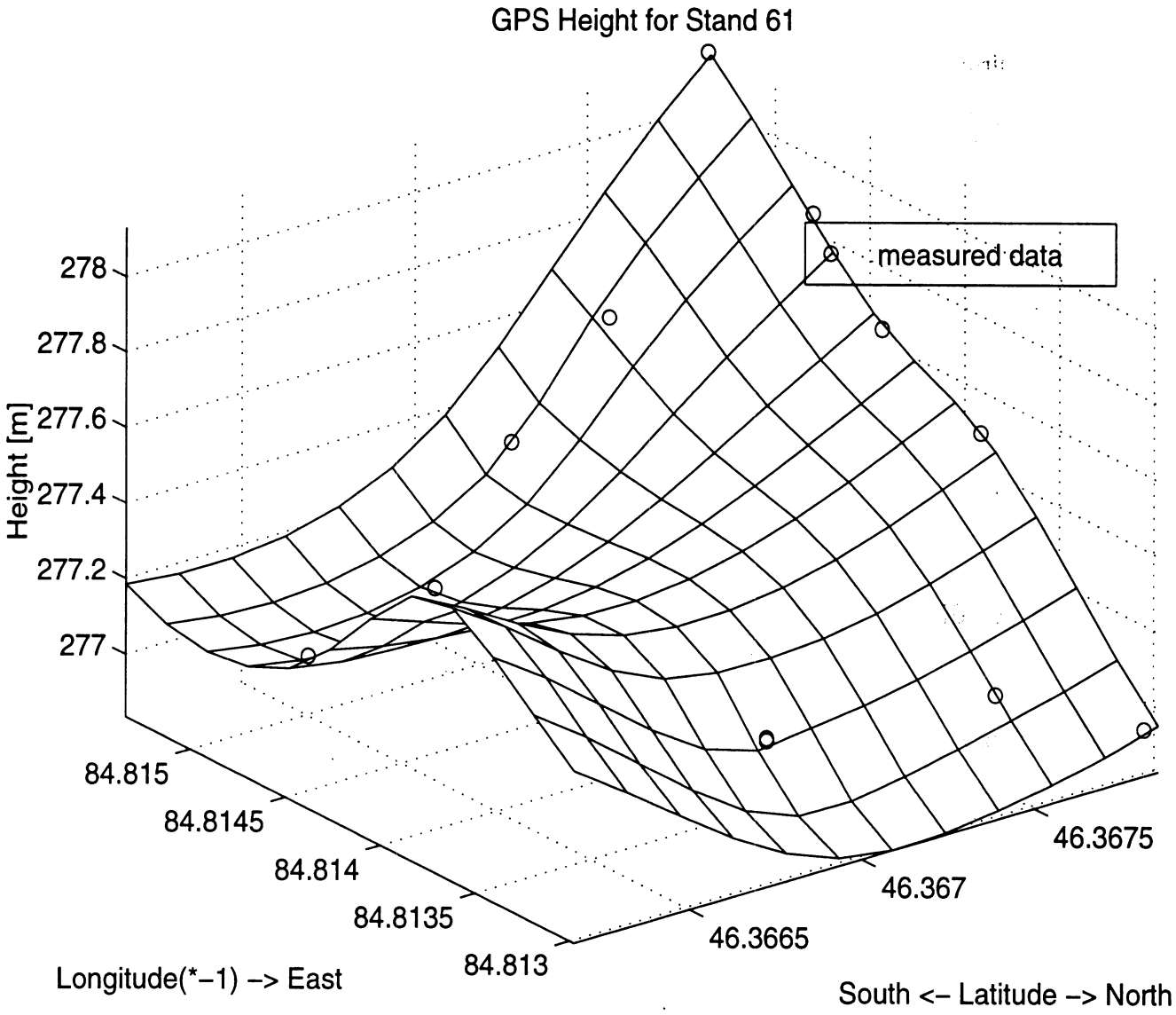

GPS Height for Stand 54
measured data
Height [m]
400
350
300
250
200
150
100
84.8015
84.801
84.8005
84.8
84.7995
Longitude(*−1) -> East
46.385
46.3855
46.386
46.3865
South <- Latitude -> North

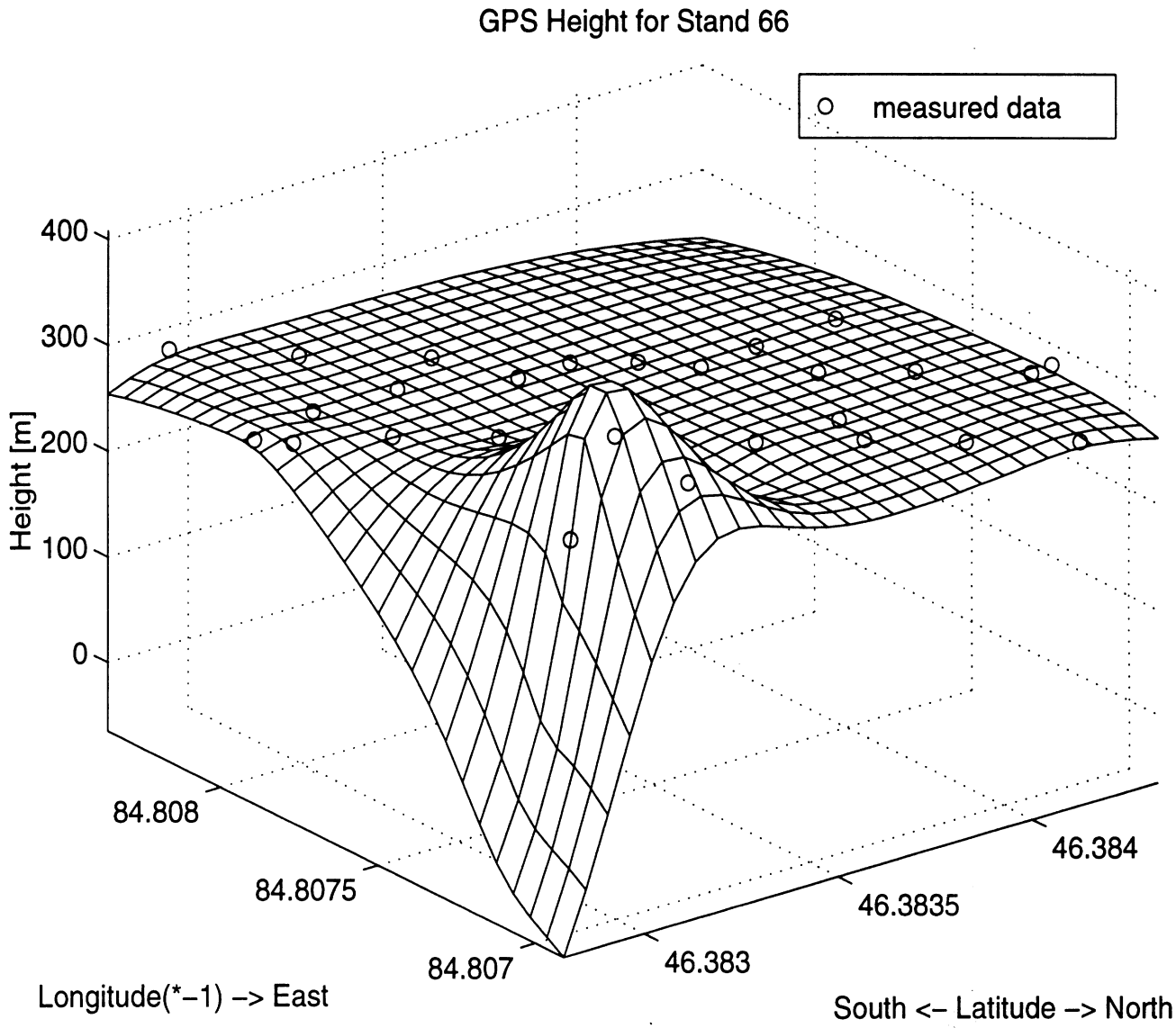

GPS Height for Stand 55
measured data
Height [m]
282.5
282
281.5
281
280.5
280
279.5
84.7965
84.796
84.7955
84.795
Longitude(*−1) -> East
46.3985
46.399
46.3995
46.4
South <– Latitude –> North

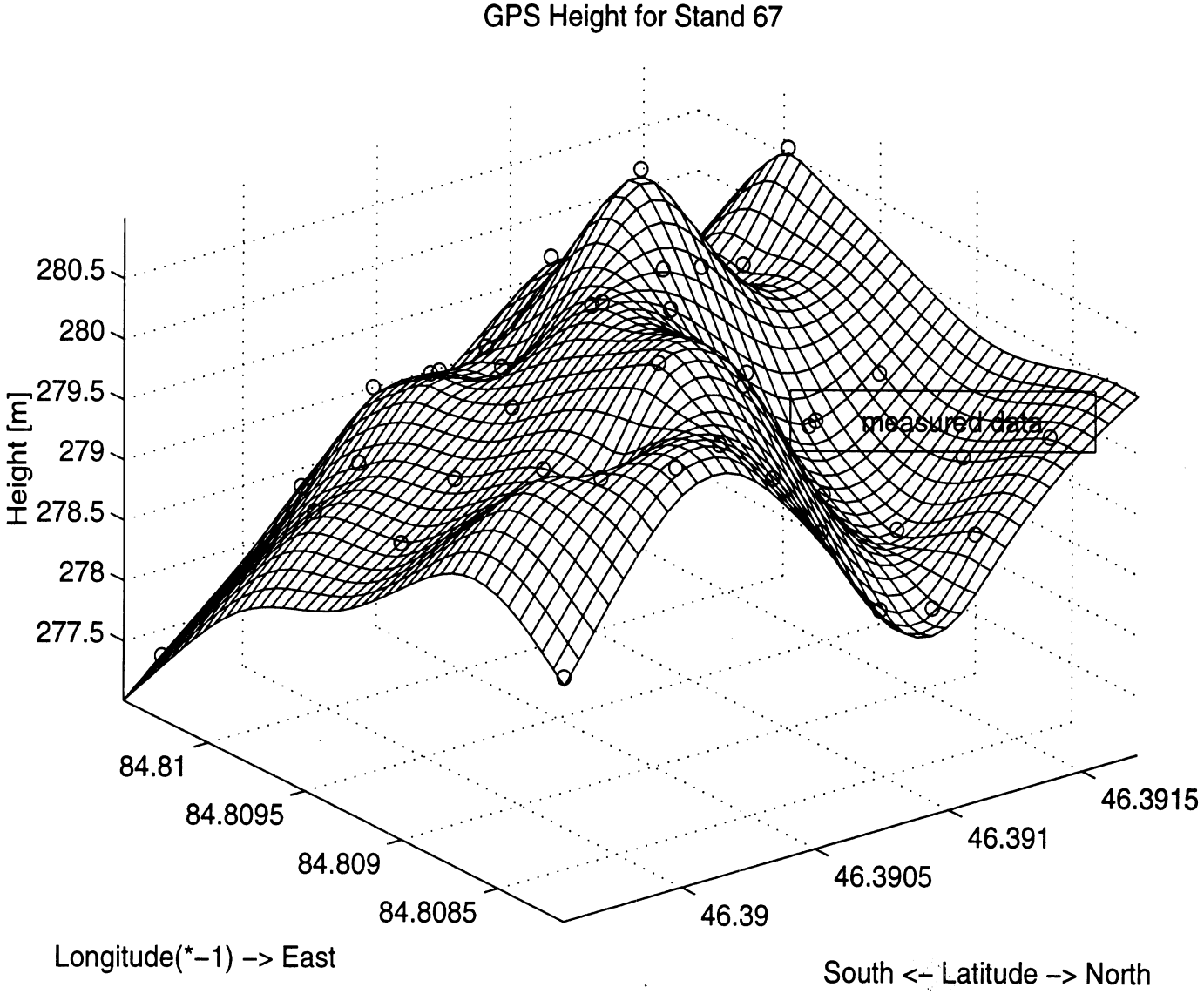

GPS Height for Stand 56
277.5
277
276.5
276
275.5
Height [m]
measured data
84.8015
84.801
84.8005
84.8
84.7995
Longitude(*−1) -> East
46.3805
46.381
46.3815
South <- Latitude -> North

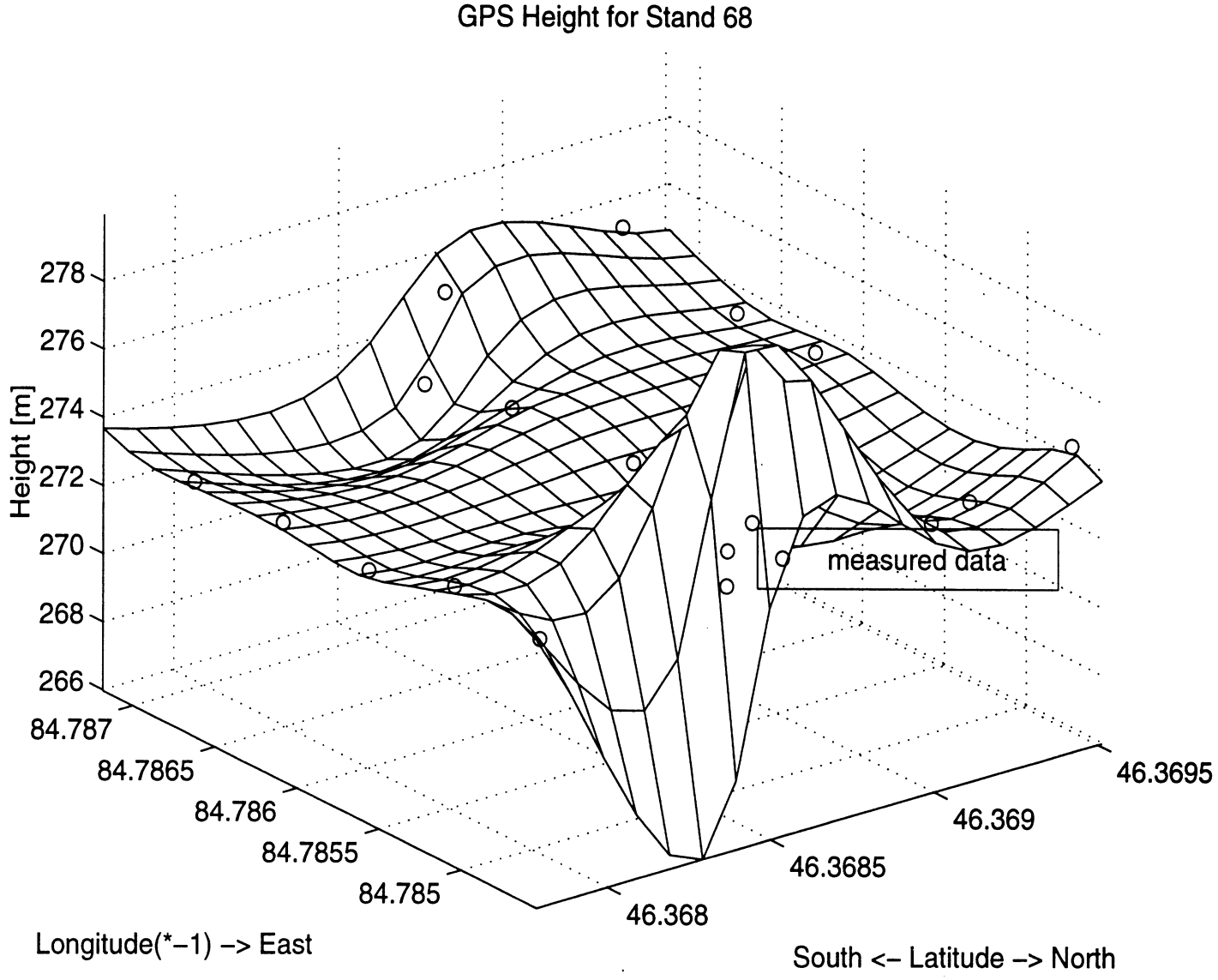

GPS Height for Stand 58
measured data
290
285
280
275
270
265
Height [m]
84.7725
84.772
84.7715
84.771
Longitude(*−1) -> East
46.3735
46.374
46.3745
46.375
South <- Latitude -> North

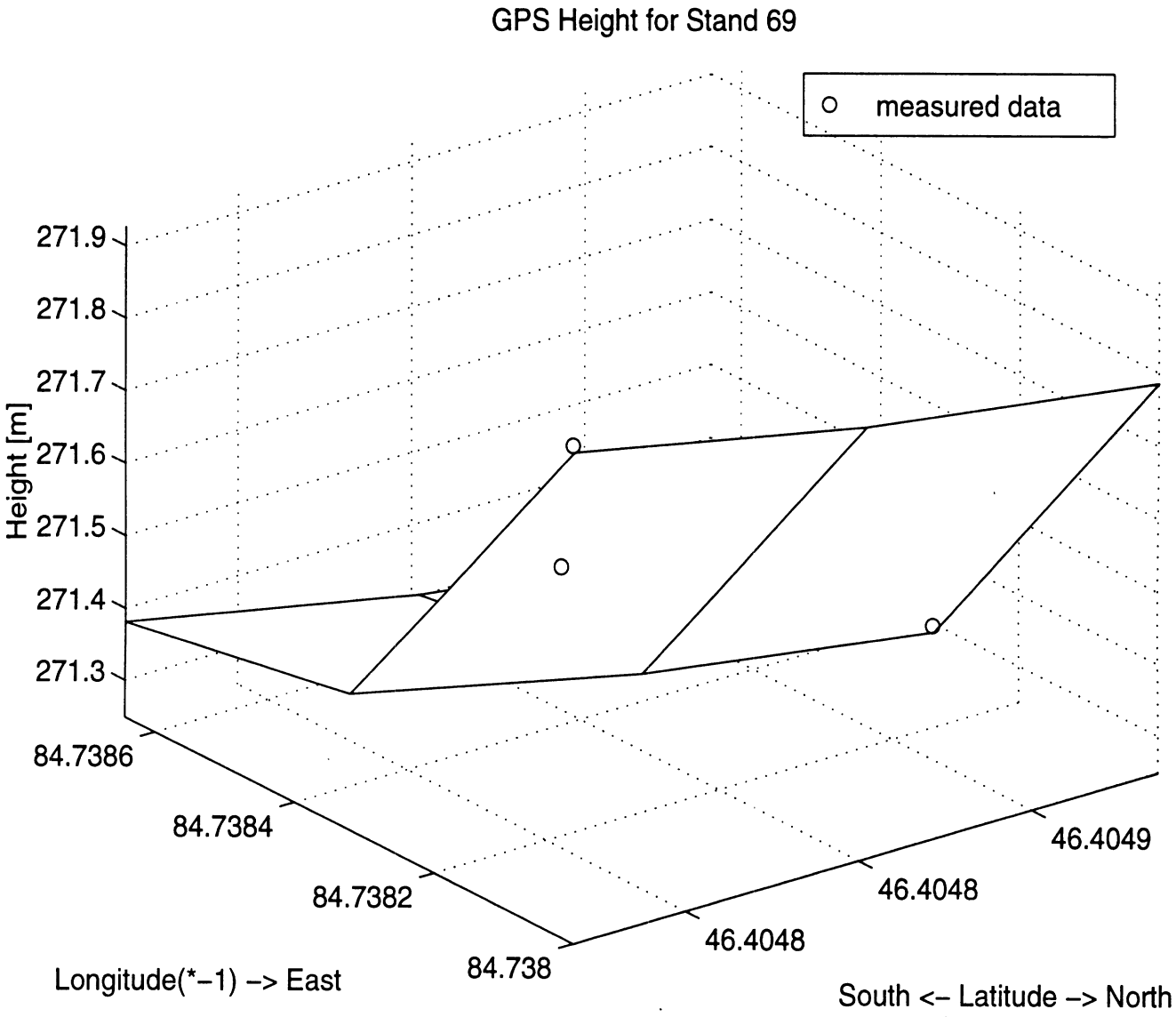

GPS Height for Stand 59
measured data
Height [m]
276.4
276.2
276
275.8
275.6
275.4
84.807
84.806
84.805
84.804
Longitude(*−1) -> East
46.366
46.3665
46.367
46.3675
South <- Latitude -> North

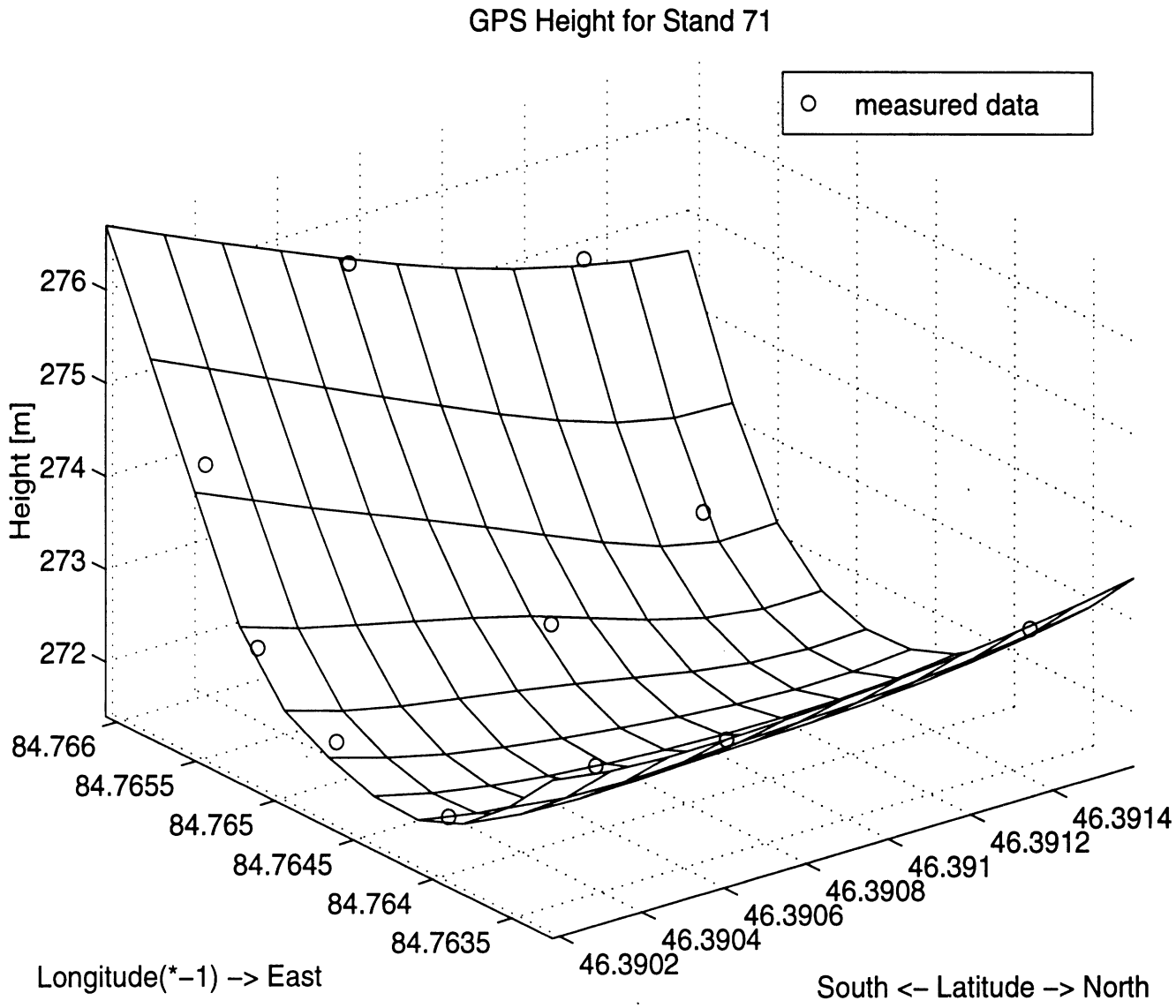

GPS Height for Stand 61
measured data
Height [m]
278
277.8
277.6
277.4
277.2
277
84.815
84.8145
84.814
84.8135
84.813
Longitude(*−1) -> East
46.3665
46.367
46.3675
South <- Latitude -> North

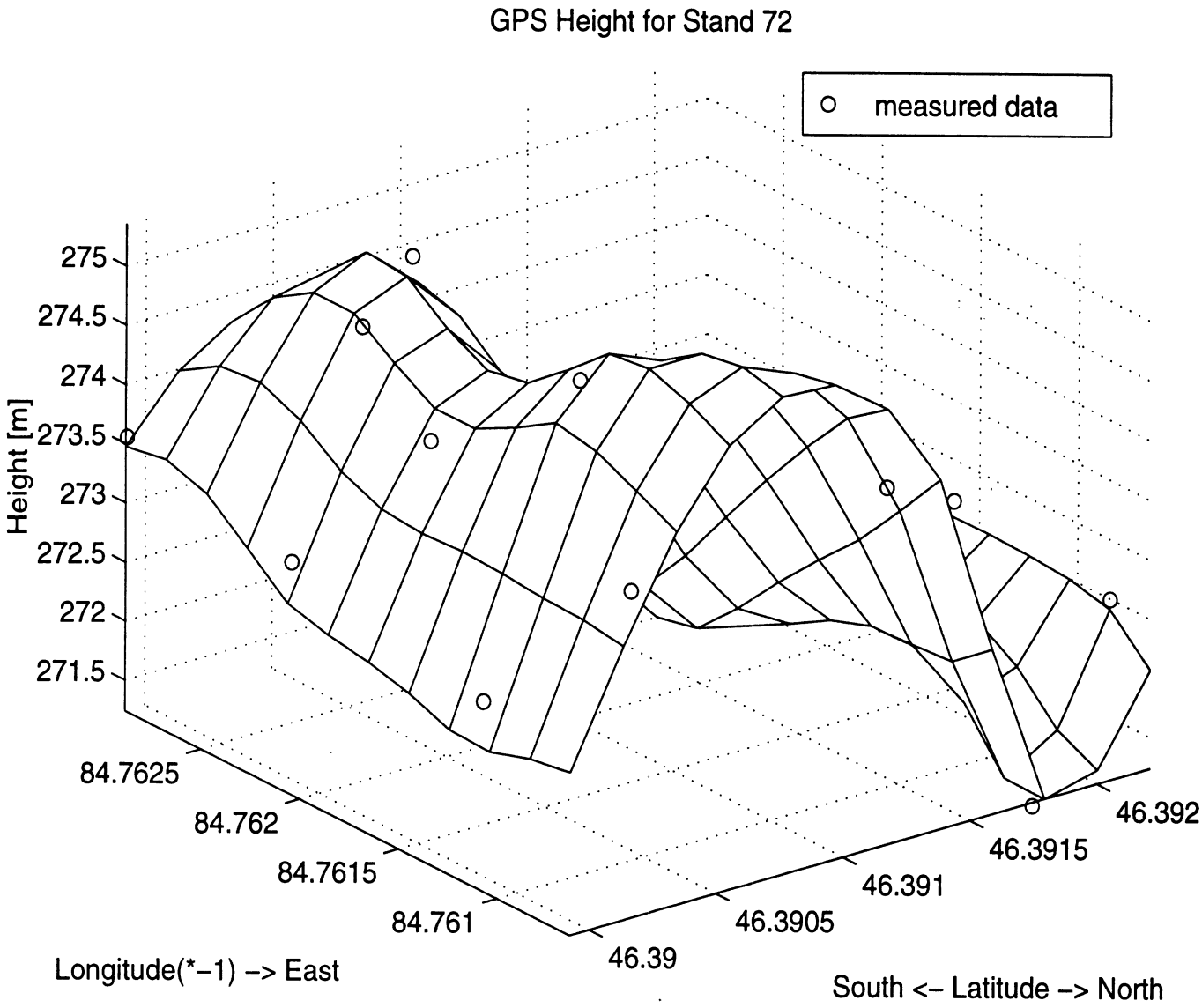

GPS Height for Stand 66
measured data
400
300
200
100
0
Height [m]
84.808
84.8075
84.807
46.383
46.3835
46.384
Longitude(*−1) -> East
South <- Latitude -> North

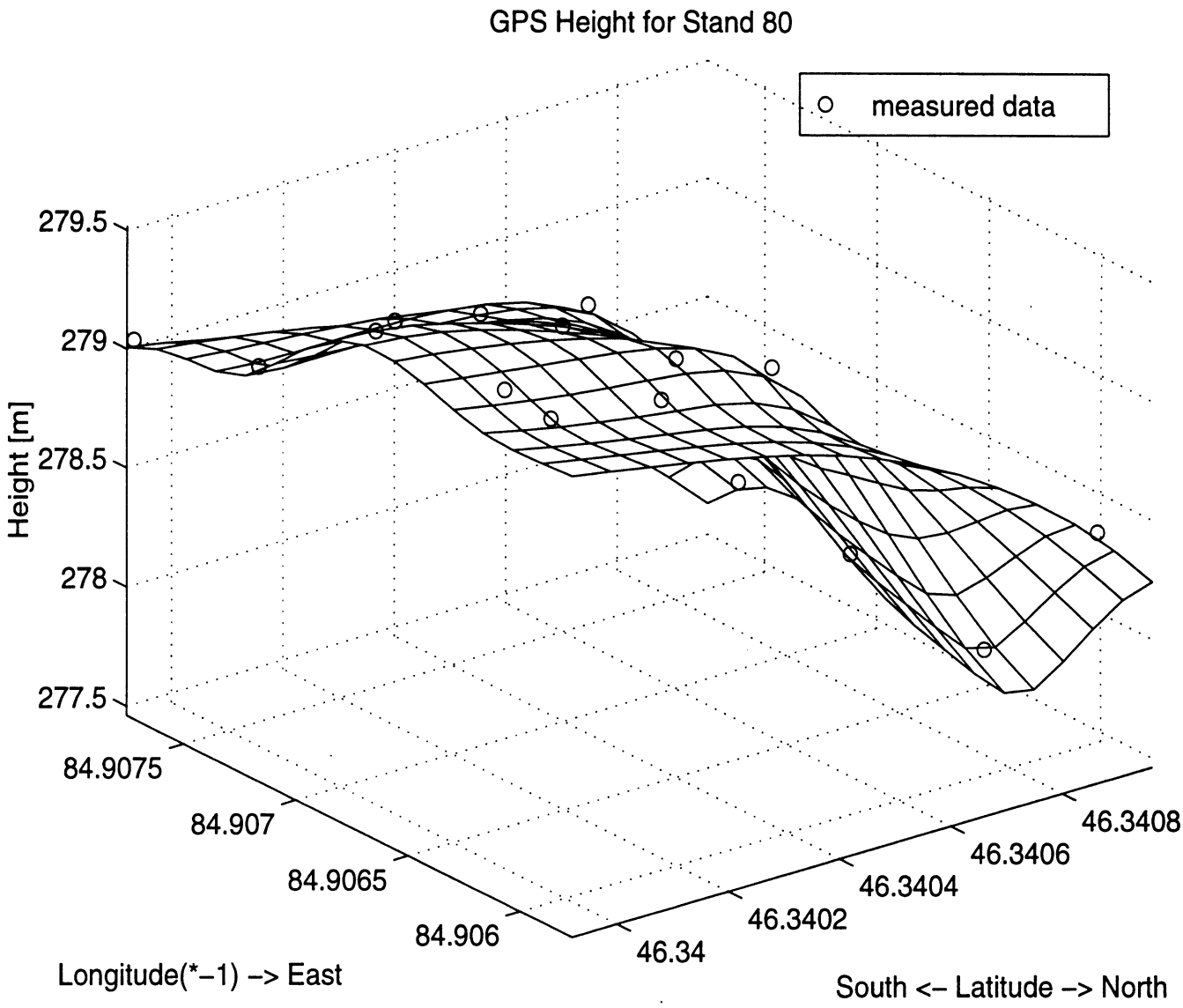

GPS Height for Stand 67
Height [m]
280.5
280
279.5
279
278.5
278
277.5
measured data
84.81
84.8095
84.809
84.8085
Longitude(*-1) -> East
46.39
46.3905
46.391
46.3915
South <- Latitude -> North

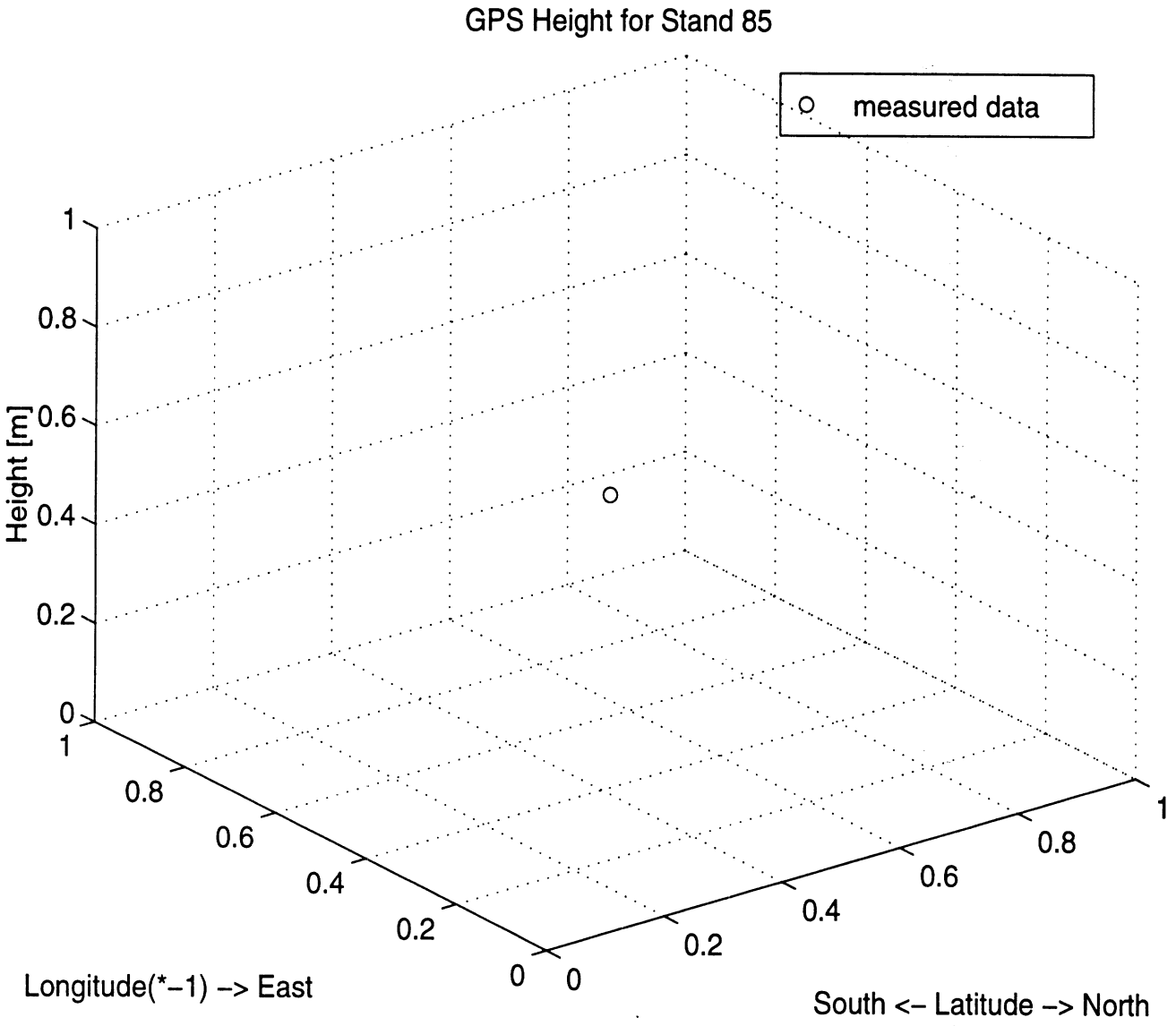

GPS Height for Stand 68
Height [m]
278
276
274
272
270
268
266
84.787
84.7865
84.786
84.7855
84.785
Longitude(*−1) -> East
46.368
46.3685
46.369
46.3695
South <- Latitude -> North
measured data


GPS Height for Stand 69
measured data
271.9
271.8
271.7
271.6
271.5
271.4
271.3
Height [m]
84.7386
84.7384
84.7382
84.738
Longitude(*-1) -> East
46.4049
46.4048
46.4048
South <- Latitude -> North


GPS Height for Stand 71
measured data
Height [m]
276
275
274
273
272
84.766
84.7655
84.765
84.7645
84.764
84.7635
Longitude(*−1) -> East
46.3902
46.3904
46.3906
46.3908
46.391
46.3912
46.3914
South <- Latitude -> North


GPS Height for Stand 72
measured data
Height [m]
275
274.5
274
273.5
273
272.5
272
271.5
84.7625
84.762
84.7615
84.761
84.76
Longitude(*−1) -> East
46.39
46.3905
46.391
46.3915
46.392
South <- Latitude -> North


GPS Height for Stand 80
measured data
279.5
279
278.5
278
277.5
Height [m]
84.9075
84.907
84.9065
84.906
Longitude(*−1) -> East
46.34
46.3402
46.3404
46.3406
46.3408
South <- Latitude -> North


GPS Height for Stand 85
measured data
Height [m]
1
0.8
0.6
0.4
0.2
0
Longitude(*-1) -> East
South <- Latitude -> North

Stand 22 - Red pine - not sapling(~10 m)

Measured by Dennis Taeyeoul on May 19(Mon.).

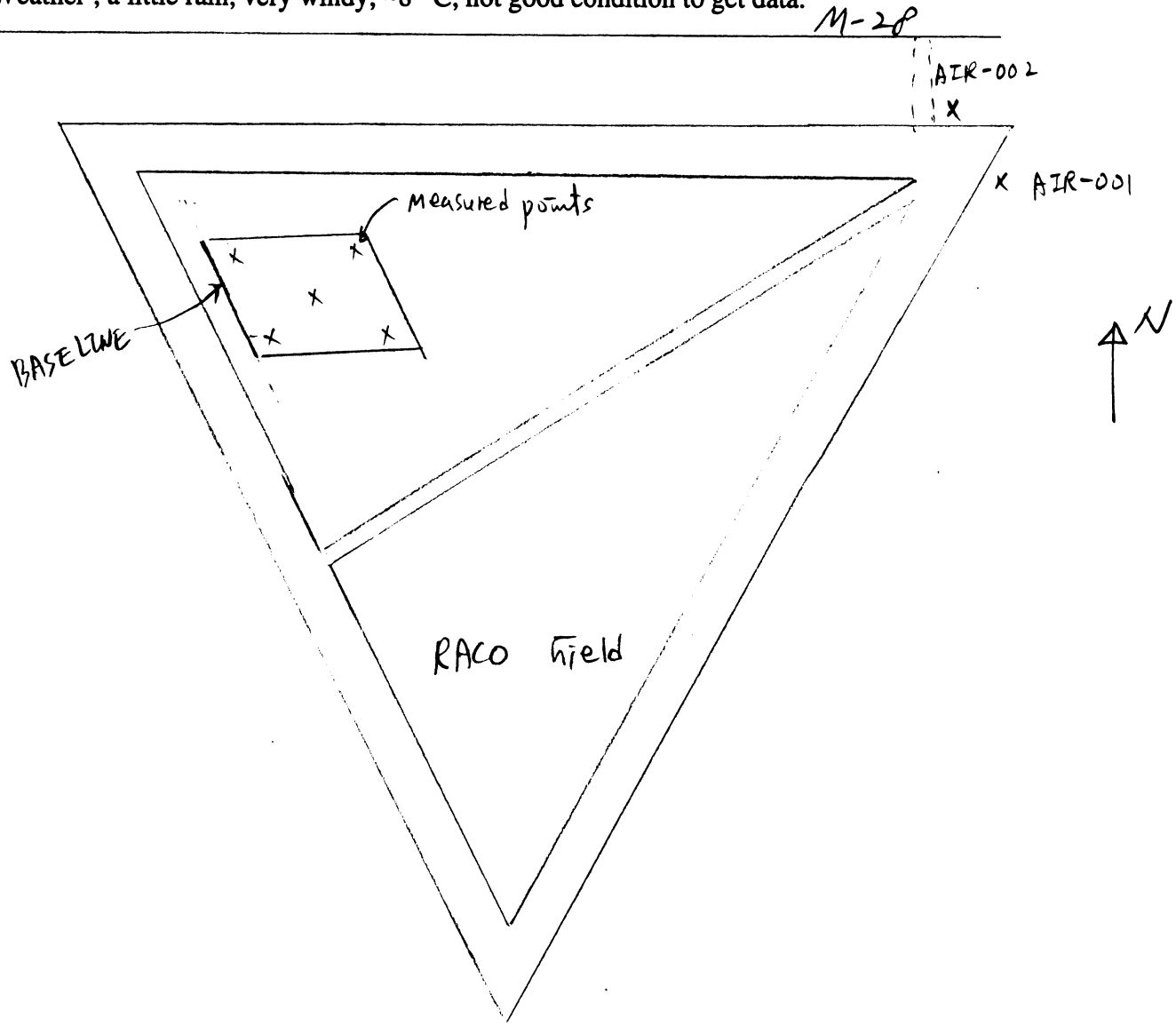
Species ; All trees are red pine(99.9%).

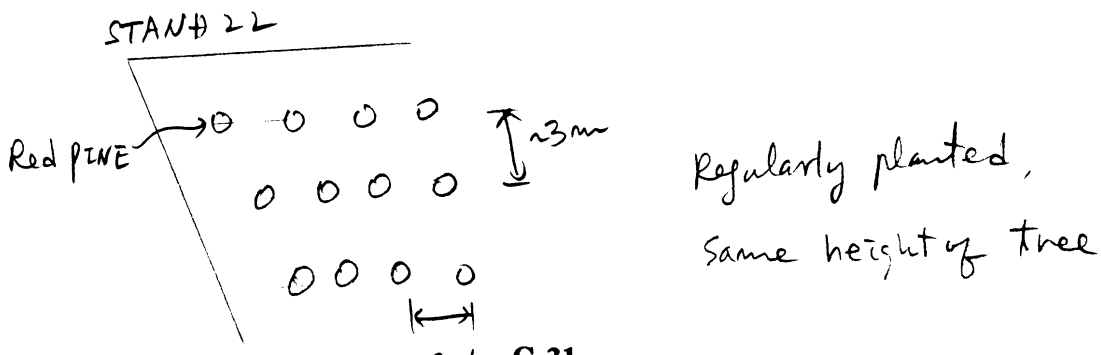
Tree height ; ~10m

Ground surface ; very flat

Tree density ; Red pines were regularly planted following East-West direction(see below figure)

Weather ; a little rain, very windy, ~8 ^{o}C, not good condition to get data.





Stand 31 - Maple - pole

Measured by Kamal, Yutaka, Taeyeoul on May 23(Fri.).

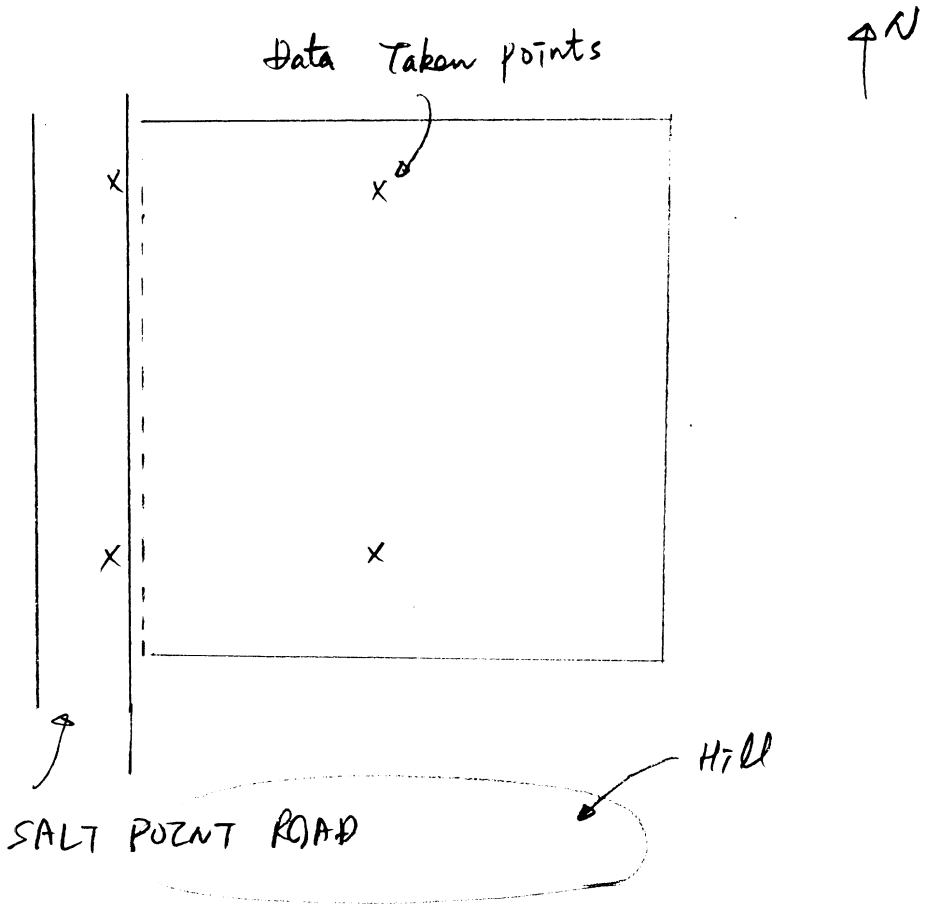
Species ; Almost of all trees are Maples(> 90%).

Tree height ; greater than 15m

Ground surface ; flat

Tree density ; not dense, 1 tree/2m*2m

Weather ; no rain, very small wind, ~15 ^{o}C, very good condition to get data.



Almost flat / SALT POINT ROAD's SLOPE IS Increasing after T5 (or End of Base line) to Southern direction

Stand 40 - Red Pine - sapling

Measured by Kamal, Yutaka, Taeyeoul on May 22(Thu.).

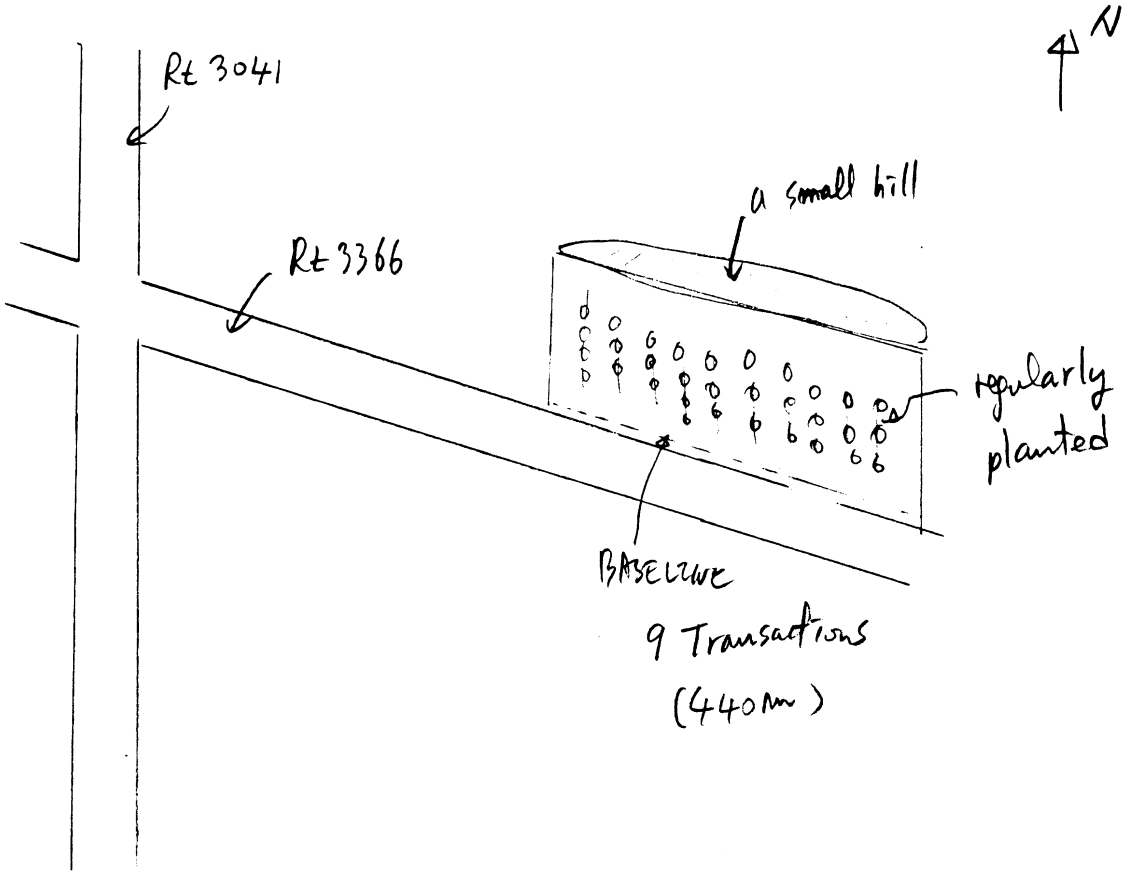
Species ; Almost of all red pine trees are regularly planted(> 90%). randomly growing jack pine.

Tree height ; greater than ~ 2m

Ground surface ; flat

Tree density ; spacing of 2m by 1m.

Weather ; no rain, no wind, ~15 ^{o}C, very good condition to get data.



Stand 49 - Aspen - sapling

Measured by Kamal, Yutaka, Taeyeoul on May 23(Fri.).

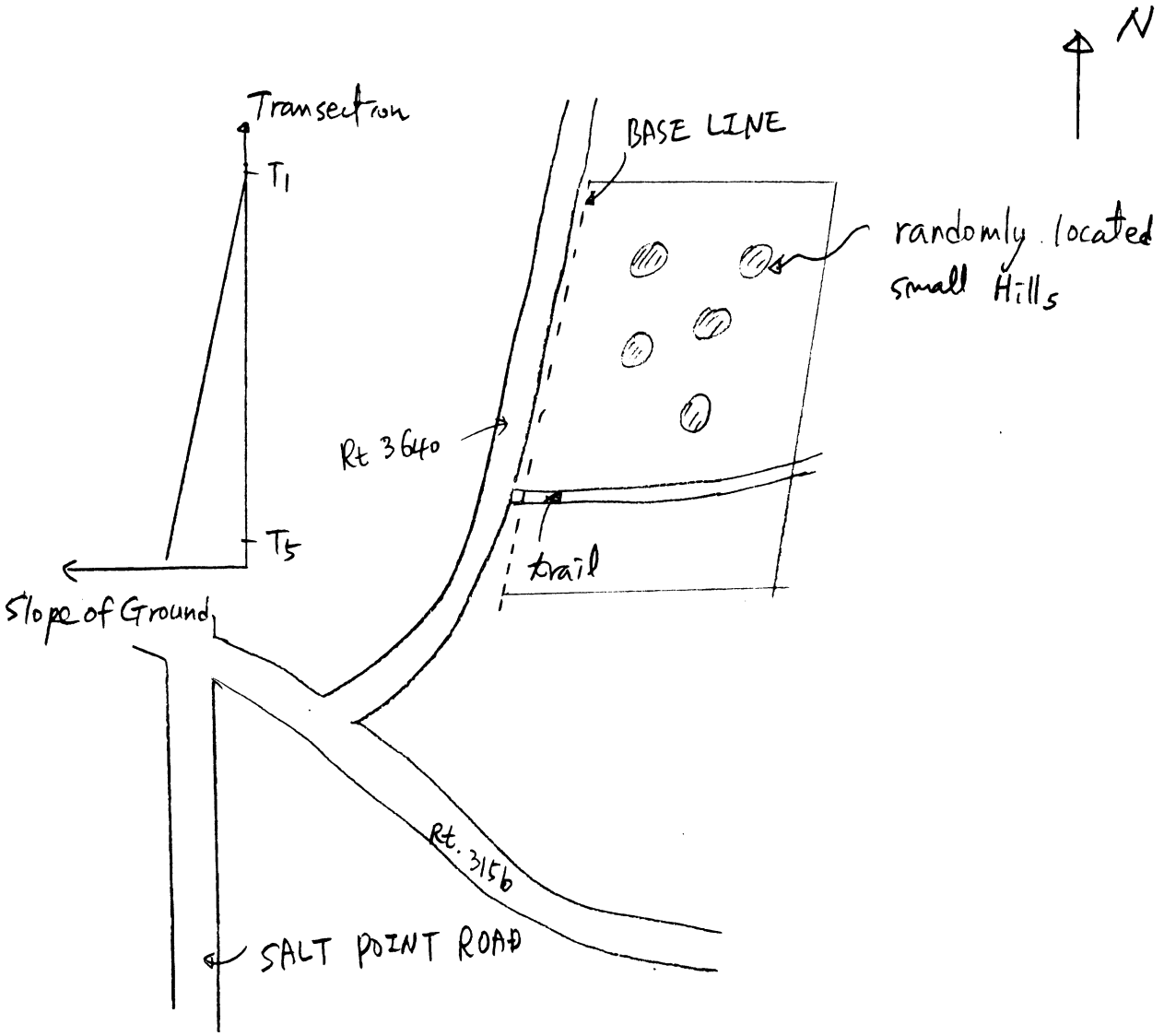
Species ; Almost of all trees are aspen(> 90%).

Tree height ; 3 ~ 5m

Ground surface ; Ground level is linearly slanted, i.e. increasing from T1 to T5.

Tree density ; very dense, hard to move

Weather ; no rain, very small wind, ~15 ^{o}C, very good condition to get data.



Stand 50 - Red Pine - mature

Measured by Kamal, Yutaka, Taeyeoul on May 24(Sat.).

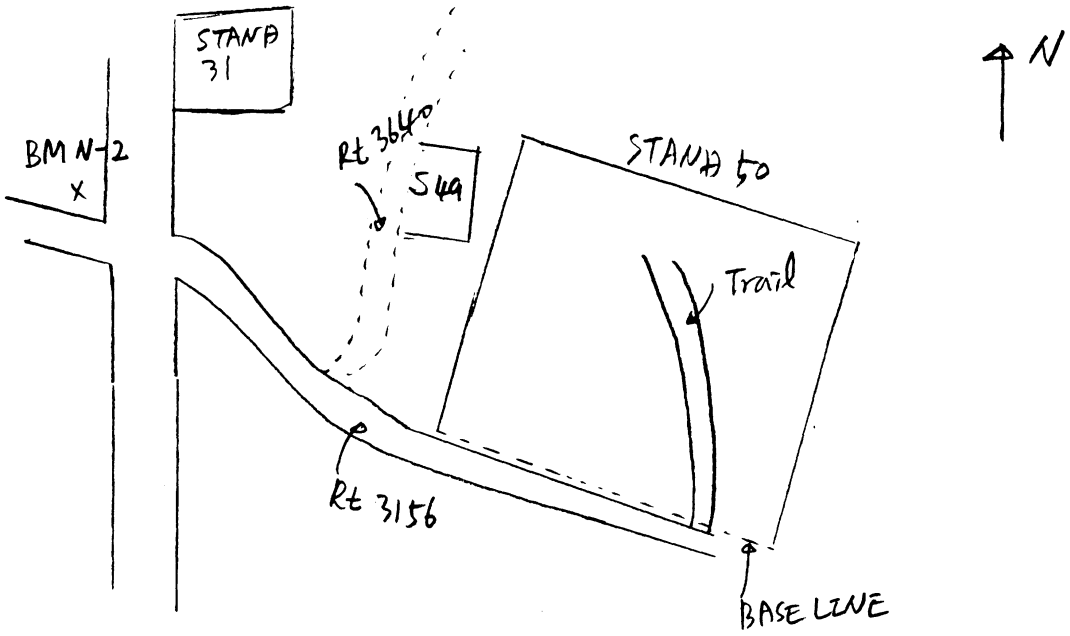
Species ; All tall trees are Maples(> 90%).

Tree height ; ~ 20m, branches come out from height of ~10m.

Ground surface ; flat

Tree density ; not dense, 1 tree/2m*2m

Weather ; no rain, very small wind, ~15 ^{o}C, very good condition to get data.



Ground of Road Rt 3156 is higher than 550's Ground, about 40 cm.

Stand 58 - Jack Pine - sapling

Measured by Yutaka, Taeyeoul on May 20(Tue.).

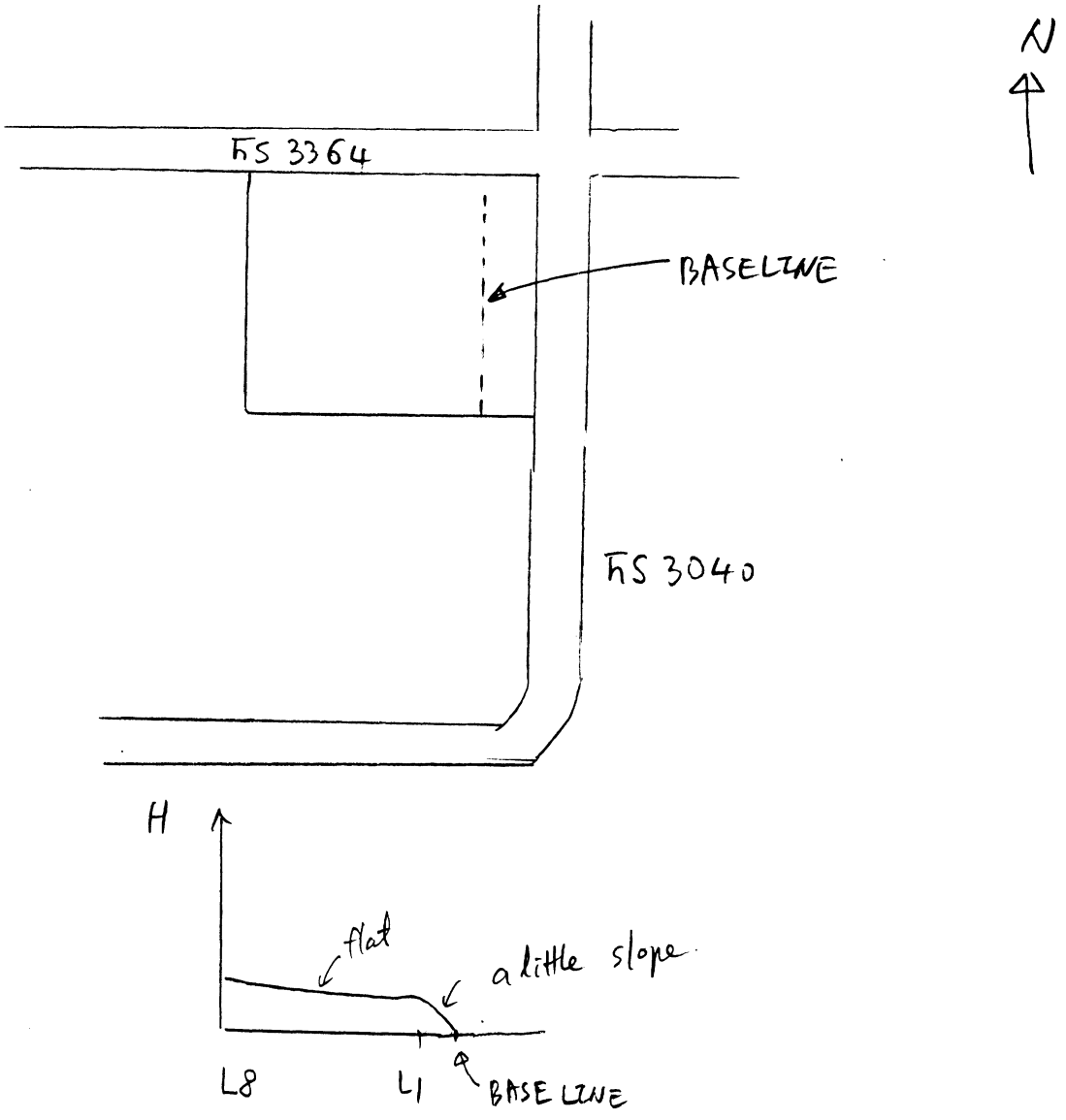
Species ; Almost of all trees are Jack pine(> 99.9%).

Tree height ; ~ 2m

Ground surface ; flat

Tree density ; Tree spacing is aoubt 2.5m by 2.5m, irregularly.

Weather ; no rain, very small wind, ~10 ^{o}C, very good condition to get data.



Stand 61 - Jack Pine - mature

Measured by Yutaka, Taeyeoul on May 21(Wed.).

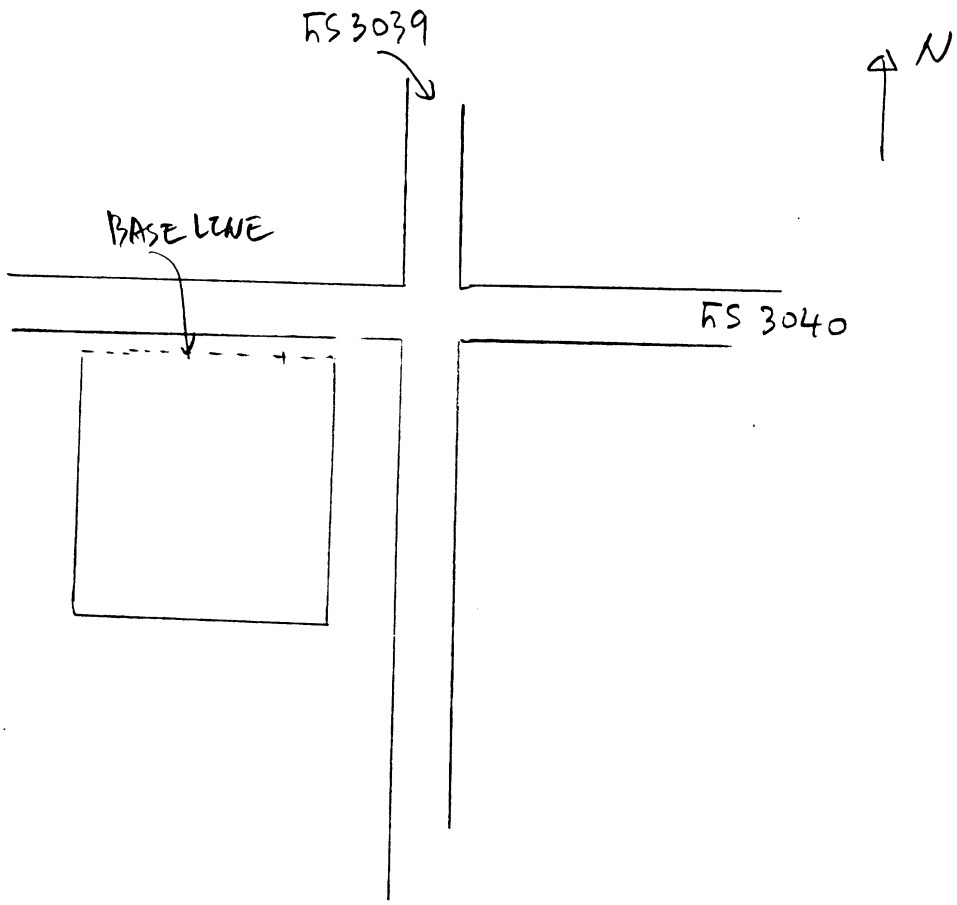
Species ; All trees are Jack pine(> 99.9%).

Tree height ; ~ 15m

Ground surface ; flat

Tree density ; randomly located, tree spacing is 2.5m by 2.5m.

Weather ; no rain, very small wind, ~15 ^{o}C, very good condition to get data.



Stand 68 - Red Pine - mature

Measured by Kamal, Yutaka, Taeyeoul on May 21(Wed.).

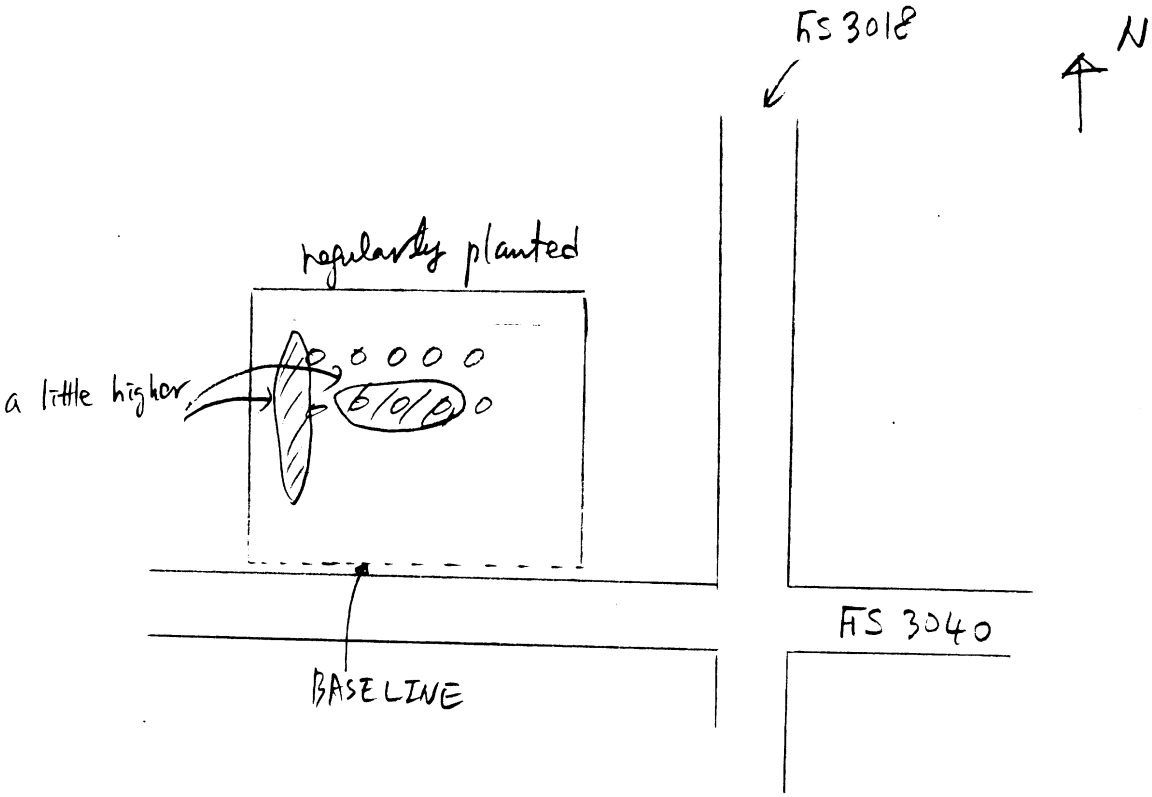
Species ; All trees are Jack pine(> 99.9%).

Tree height ; greater than ~ 15m

Ground surface ; some locations are higher, generally flat.

Tree density ; regularly planted, tree spacing is 2.5m by 2.5m.

Weather ; no rain, no wind, ~15 ^{o}C, very good condition to get data.



Stand 71 and 72 - Red Pine - pole

Measured by Kamal, Yutaka, Taeyeoul on May 22(Thu.).

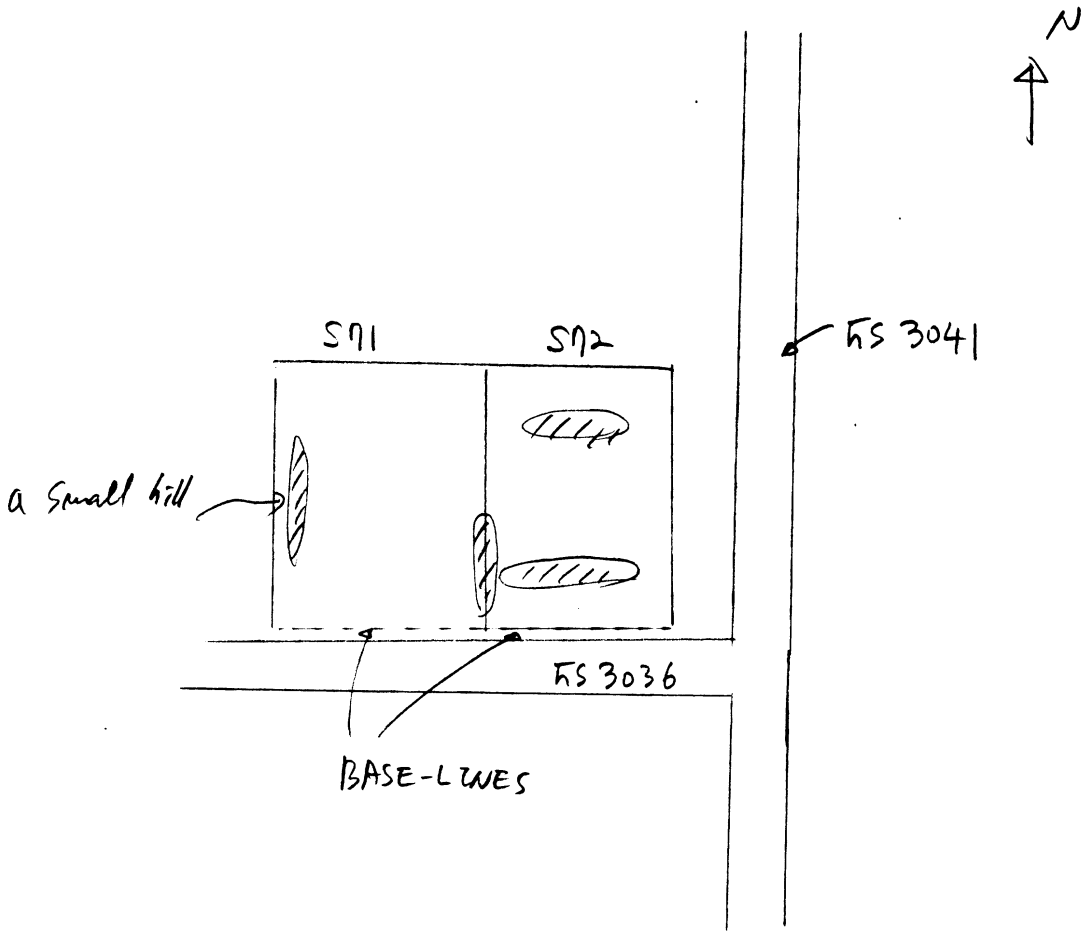
Species ; All trees are Red pine(> 99.9%).

Tree height ; 10 ~ 15m

Ground surface ; flat and 2 ~3 hills

Tree density ; Almost of all red pine was already logged. There are several trees near hills.

Weather ; no rain, no wind, ~15 ^{o}C, very good condition to get data.



Appendix D:
Data of Ground Control Point(=GCP) Location

Table D-1 shows the information on GCPs.
Figure D-1 shows location of each GCP.
The detail data record is shown afterwards.
All the data are expressed on WGS coordinate.

Including the cover sheet, **appendix D** is totally 7 pages.

Table D-1 Ground Control Point(GCP) description (1 of 2)

GCP NO.	Description	Area	Measured by	Measured date
R2	Road intersection of Centerline Road & 20 Mile Road.	Rudyard	Leland,Dennis, Taeyeoul, Yutaka	May 18
R4	Road intersection of Tilson Road & 18 Mile Road. At the northwestern corner, there is "Christian Reformed Church".	Rudyard	the same as above	May 18
R5	Road intersection of Centerline Road & M48.	Rudyard	the same as above	May 18
R6	Road intersection of USFS3161(Flatfoot Road) & 3367(snow mobile trail)	Raco	kamal, Taeyeoul, Yutaka	May 24
R7	Cross point of USFS3161(Flatfoot Road) & Power line The power line is the same power line which is extending along USFS3364.	Raco	the same as above	May 24
R8	Road intersection of USFS3364 & USFS3018. USFS3364 is running from East to West and there is power line along USFS3364.	Raco	Leland, Dennis	May 20
R9	Road intersection of M28 & USFS3131(Sullivan Creek T.T.)	Raco	the same as above	May 2
R10NEAR	Road intersection of M28 & USFS3157(Rexford Road)	Raco	Kamal, Taeyeoul,Yutaka	May 24
R10	Road intersection of USFS3364 & USFS3157(Rexford Road)	Raco	the same as above	May 24
R11	Road intersection of USFS3159(Salt Point Road) & Wyckoff Road. This GCP is located 620 meter south of the lakeshore of Lake Superior. Wyckoff Road is not shown in the map.	Mc Nearney	the same as above	May 24
R12	Located West of Naomikong Point. This GCP is along the FH42(Curley Lewis Road) and is located at the cross point of FH42 & Road to Naomikong pond(ball field).	Mc Nearney	the same as above	May 24
R13	Located 4miles West of Naomikong Point. This GCP is along the FH42(Curley Lewis Road) and is located at the cross point of FH42 & North Country Trail.	Mc Nearney	the same as above	May 24
R14	The Northeast corner of Raco airfield runway.	Raco	Leland, Dennis	May 20
R15	The Northwest corner of Raco airfield runway.	Raco	the same as above	May 20

Table D-1 Ground Control Point(GCP) description (2 of 2)

GCP NO.	Description	Area	Measured by	Measured date
R16	The middle point between R15 and R17. (Raco airfield runway.)	Raco	Leland, Dennis	May 20
R17	The South corner of Raco airfield runway.	Raco	the same as above	May 20
R18	Road intersection of M28 & USFS3154(Ranger Road)	Raco	Dennis, Yi-Cheng	May 24
R19	Road intersection of USFS3364 & USFS3154(Ranger Road)	Raco	the same as above	May 24
R20	Road intersection of USFS3581 & USFS3154(Ranger Road)	Raco	the same as above	May 24
R21	Road intersection of USFS3622 & USFS3154(Ranger Road)	Raco	Taeyeoul, Yutaka	May 22
R22	Road intersection of USFS3159(Salt Point Road) & USFS3156(Richardson Avery Grade)	Mc Nearney	Taeyeoul, Yutaka	May 20
R24	Road intersection of M28 & USFS3139(Dick Road)	Raco	Kamal, Taeyeoul, Yutaka	May 24
R30	Road intersection of M28 & USFS3161(Flatfoot Road)	Raco	the same as above	May 24
R31	Road intersection of USFS3605 & USFS3364	Raco	Dennis, Yi-Cheng	May 24
R33	Road intersection of Centerline Road & M48.	Rudyard	the same as above	May 24
R34	Road intersection of Kallio Road & 19 Mile Road.	Rudyard	the same as above	May 24
R40	This GCP is located at the entrance of Cryderman hill. This point is along USFS3159 (Salt Point Road) . This GCP is located 410 meter south of the lakeshore of Lake Superior.	Mc Nearney	Kamal, Taeyeoul, Yutaka	May 24
R41	Road intersection of USFS3159 (Salt Point Road) & USFS3150(Curley Lewis Road).	Mc Nearney	Kamal, Taeyeoul, Yutaka	May 24
R42	Road intersection of USFS3364 & USFS3040. This GCP is located northeastern corner of Stand 58.	Raco	Taeyeoul,Yutaka	May 20

Remark)

1. The map shown below is very helpful to know the exact location of the GCPs.
   "Eastern Upper Peninsula of Michigan" $3.95 ISBN 1-56464-354-9
   Distributed by Universal Map, Inc. P.O. Box 15 795 Progress Court Williamston, MI. 48895 Phone (517)-655-5641
   Stock No. MI206

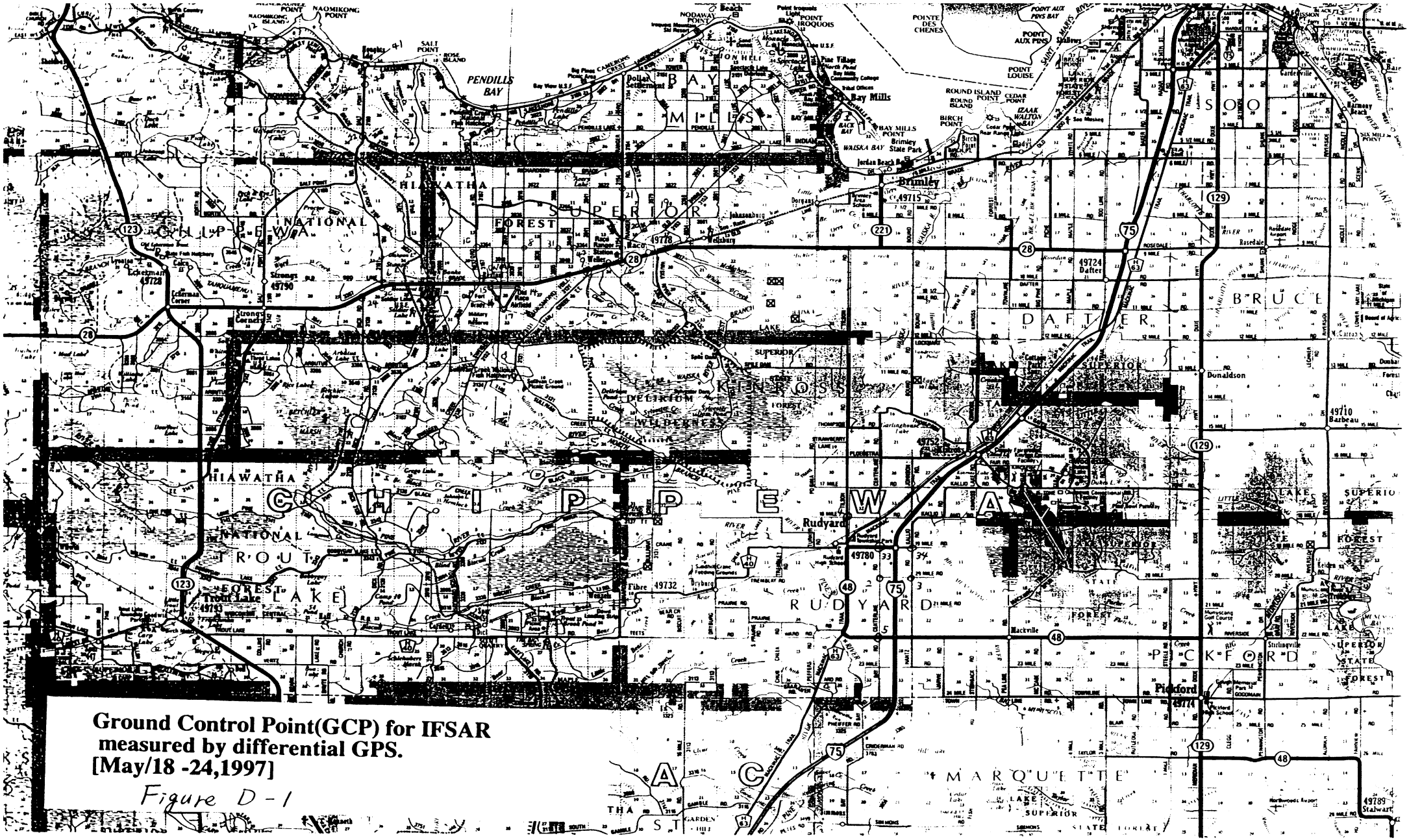

Ground Control Point(GCP) for IFSAR
measured by differential GPS.
[May/18 -24,1997]

Figure D-1

GCP measurement of Ground Control Points(=GCPs)

Pnt #	Latitude	Longitude	Height	Code	
1005,	46.2159930864,	-84.5716630728,	207.031,	R2-1	GCP "R2" No.1
1006,	46.2160548285,	-84.5715898442,	206.907,	R2-2	GCP "R2" No.2
1007,	46.2159567158,	-84.5715958889,	206.842,	R2-3	GCP "R2" No.3
1008,	46.2159595341,	-84.5717193246,	206.875,	R2-4	GCP "R2" No.4
1009,	46.2160450130,	-84.5717210675,	206.933,	R2-5	GCP "R2" No.5
1010,	46.2451467360,	-84.5924850466,	211.120,	R4-1	GCP "R4" No.1
1011,	46.2451885535,	-84.5924081648,	210.922,	R4-2	GCP "R4" No.2
1012,	46.2450965072,	-84.5924086203,	210.933,	R4-3	GCP "R4" No.3
1013,	46.2450922316,	-84.5925334188,	211.020,	R4-4	GCP "R4" No.4
1014,	46.2451822000,	-84.5925362311,	211.025,	R4-5	GCP "R4" No.5
1000,	46.1870756889,	-84.5716812758,	203.182,	R5-1	GCP "R5" No.1
1001,	46.1871502019,	-84.5715828700,	202.900,	R5-2	GCP "R5" No.2
1002,	46.1870113742,	-84.5715860187,	203.053,	R5-3	GCP "R5" No.3
1003,	46.1870087821,	-84.5717947099,	202.910,	R5-4	GCP "R5" No.4
1004,	46.1871423580,	-84.5717901641,	202.922,	R5-5	GCP "R5" No.5
2022	46.358503917	-84.893683442	281.662	R6	GCP "R6"
2023	46.367233003	-84.893898458	277.844	R78	GCP "R7" No.1
2024	46.367112186	-84.893884428	276.955	R78E	GCP "R7" No.2
1005	46.375190372	-84.801734792	276.557	R8	GCP at road intersection of 3364&3018
1000	46.388173172	-84.803176236	278.946	R8	Maybe wrong
1001	46.388166236	-84.803181056	278.938	R8-CHECK	Maybe wrong
1000	46.365141342	-84.760581550	263.327	R8	Maybe GCP "R9"
2020	46.375215489	-84.833054431	283.468	R10E	GCP "R10" (Center)
2019	46.358734100	-84.829831186	278.615	R10NEAR	GCP "R10Near"
2008,	46.4549477881,	-84.9058569749,	205.738,	R11F	GCP "R11" No.1
2009,	46.4549553575,	-84.9059144442,	205.665,	R11E	GCP "R11" No.2 (Center)
2014,	46.4730625042,	-84.9573431082,	213.650,	R12A	GCP "R12" No.1
2015,	46.4731295504,	-84.9569849900,	214.061,	R12B	GCP "R12" No.2
2016,	46.4729805411,	-84.9566907434,	214.475,	R12C	GCP "R12" No.3
2017,	46.4865157492,	-85.0394154128,	211.261,	R13A	GCP "R13" No.1
1000	46.356880953	-84.804882997	274.760	R14	GCP "R14"
1001	46.356454694	-84.824510278	277.009	R15	GCP "R15"
1002	46.356454703	-84.824510278	277.005	R15-2	GCP "R15"
1003	46.350713006	-84.819791794	275.375	R16	GCP "R16"
1004	46.344839564	-84.814679747	275.618	R17	GCP "R17"
1008,	46.3694893633,	-84.7388115976,	259.044,	IT-1	GCP "R18" No.1
1009,	46.3694390760,	-84.7390001988,	259.091,	IT-2	GCP "R18" No.2
1010,	46.3693180115,	-84.7388104672,	258.946,	IT-3	GCP "R18" No.3
1011,	46.3732296627,	-84.7390470582,	259.416,	IT19-1	GCP "R19" No.1
1012,	46.3733355559,	-84.7390545540,	259.473,	IT19-2	GCP "R19" No.2
1013,	46.3733039973,	-84.7389944168,	259.513,	IT19-3	GCP "R19" No.3

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1014,46.3896860152,-84.7390268249,266.384,IT20-1     GCP "R20" No.1
1015,46.3896005033,-84.7390261682,266.409,IT20-2     GCP "R20" No.2
1016,46.3895905163,-84.7391350773,266.300,IT20-3     GCP "R20" No.3

2040,46.4042942552,-84.7392223628,272.399,R21A       GCP "R21" No.1
2041,46.4044018162,-84.7392304077,272.365,R21B       GCP "R21" No.2
2042,46.4043883303,-84.7391176508,272.431,R21C       GCP "R21" No.3
2043,46.4042878505,-84.7391207019,272.440,R21D       GCP "R21" No.4
2044,46.4041332027,-84.7391172883,272.454,R21E       GCP "R21" No.5
2045,46.4040676061,-84.7391176308,272.468,R21F       GCP "R21" No.6
2046,46.4040730130,-84.7392110507,272.476,R21G       GCP "R21" No.7
2047,46.4041331362,-84.7392097999,272.479,R21H       GCP "R21" No.8
2048,46.4040949452,-84.7391640552,272.561,R21I       GCP "R21" No.9
2049,46.4043478102,-84.7391624788,272.504,R21J       GCP "R21" No.10

1000,46.4297625588,-84.9061364517,266.469,BM NEAR ST45 --->GCP "R22" Corner_1
1002,46.4297385741,-84.9059882138,266.574,ROAD CORN ST45 ->GCP "R22" Corner_2
1003,46.4295992170,-84.9059718765,266.597,ROAD CORN ST45 ->GCP "R22" Corner_3
1004,46.4296658391,-84.9061221572,266.561,ROAD CORN ST45 ->GCP "R22" Corner_4
1005,46.4296928091,-84.9060537808,266.666,ROAD CORN ST45 ->GCP "R22" Center

2025 46.351503847  -84.905825956  275.119 R24        GCP "R24"

2021 46.356631278  -84.893252253  282.384 R30        GCP "R30"

1017,46.3751789172,-84.7809876803,275.045,IT31-1     GCP "R31" No.1
1018,46.3751902311,-84.7808610433,274.628,IT31-2     GCP "R31" No.2
1019,46.3752989637,-84.7808818752,274.445,IT31-3     GCP "R31" No.3

1020 46.230411150  -84.571541517  210.555 IT33-1        GCP "R33" No.1
1023 46.230559069  -84.571815319  210.620 IT33-32       GCP "R33" No.2
1024 46.230559042  -84.571612122  210.558 IT33-42       GCP "R33" No.3

1025 46.230471825  -84.550923908  209.141 IT34-1        GCP "R34" No.1
1026 46.230474958  -84.550780092  209.158 IT34-2        GCP "R34" No.2
1027 46.230584964  -84.550770667  209.170 IT34-3        GCP "R34" No.3

2012,46.4586133798,-84.9058626065,205.821,CRYDERMAN1    GCP "R40"
2013,46.4649589117,-84.9058862222,185.549,CORNER-LAKE   GCP "R41"

1030 46.375154703  -84.770503836  274.736 S58-CORNER1 GCP "R42" corner1
1031 46.375151878  -84.770375394  274.802 S58-CORNER2 GCP "R42" corner2
1032 46.375287639  -84.770373375  274.897 S58-CORNER3 GCP "R42" corner3
1033 46.375421111  -84.770367964  275.173 S58-CORNER4 GCP "R42" corner4
1034 46.375418719  -84.770498033  275.033 S58-CORNER5 GCP "R42" corner5
1035 46.375284444  -84.770503714  274.807 S58-CORNER6 GCP "R42" corner6
1036 46.375154783  -84.770503872  274.743 S58-CORNER7 GCP "R42" corner7
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Appendix E: NGS Data Sheet

Two benchmarks are used in this measurement. Here are the orignal sources of these two benchmarks.
Including the cover sheet, appendix E is totally 6 pages.

The NGS Data Sheet

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DATABASE = Sybase ,PROGRAM = datasheet, VERSION = 5.21
      Retrieval Date = MAY  8, 1997          Version = 5.21
Starting Datasheet Retrieval...
1       National Geodetic Survey,   Retrieval Date = MAY  8, 1997
 RJ1102 ***********************************************************************
 RJ1102  DESIGNATION -  OVERPASS
 RJ1102  PID         -  RJ1102
 RJ1102  STATE/COUNTY-  MI/CHIPPEWA
 RJ1102  USGS QUAD   -  RUDYARD (1977)
 RJ1102
 RJ1102                        *CURRENT SURVEY CONTROL
 RJ1102
 RJ1102* NAD 83(1994)-  46 11 14.23823(N)     084 33 44.09326(W)      ADJUSTED
 RJ1102* NAVD 88     -       204.      (meters)     669.      (feet)  SCALED
 RJ1102
 RJ1102  LAPLACE CORR-          -3.49  (seconds)                       DEFLEC96
 RJ1102  GEOID HEIGHT-         -36.07  (meters)                        GEOID96
 RJ1102
 RJ1102  HORZ ORDER  -  THIRD
 RJ1102
 RJ1102
 RJ1102
 RJ1102.The horizontal coordinates were established by classical geodetic methods
 RJ1102.and adjusted by the National Geodetic Survey in February 1997.
 RJ1102
 RJ1102.The orthometric height was scaled from a topographic map.
 RJ1102
 RJ1102.The Laplace correction was computed from DEFLEC96 derived deflections
 RJ1102
 RJ1102.The geoid height was determined by GEOID96.
 RJ1102
 RJ1102;                    North          East      Units   Scale      Converg.
 RJ1102;SPC MI N      -   158,934.365 8,188,150.489   MT  0.99990429 +1 45 43.1
 RJ1102;UTM  16       - 5,117,745.562   688,120.601   MT  1.00003505 +1 45 34.6
 RJ1102
 RJ1102:                Primary Azimuth Mark                     Grid Az
 RJ1102:SPC MI N      -  OVERPASS AZ MK                          265 03 18.2
 RJ1102:UTM  16       -  OVERPASS AZ MK                          265 03 26.7
 RJ1102
 RJ1102|-----------------------------------------------------------------------|
 RJ1102| PID    Reference Object                    Distance      Geod. Az     |
 RJ1102|                                                          dddmmss.s    |
 RJ1102|        OVERPASS RM 1                      29.329 METERS 12119        |
 RJ1102|        OVERPASS RM 2                      16.923 METERS 20456        |
 RJ1102| RJ1112 MAPLE HILL MICROWAVE MAST         APPROX.17.4 KM 2584451.2    |
 RJ1102|        OVERPASS AZ MK                                   2664901.3    |
 RJ1102| RJ1101 RUDYARD BELL TEL CO MICROWAVE     APPROX. 6.1 KM 3483321.4    |
 RJ1102|-----------------------------------------------------------------------|
 RJ1102
 RJ1102                        SUPERSEDED SURVEY CONTROL
 RJ1102
 RJ1102  NAD 83(1986)-  46 11 14.23079(N)     084 33 44.09122(W)      ADJUSTED
 RJ1102  NAD 27      -  46 11 14.16536(N)     084 33 43.92730(W)      ADJUSTED
 RJ1102
 RJ1102.Superseded values are not recommended for survey control.
 RJ1102.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
 RJ1102.See file format.dat to determine how the superseded data were derived.
 RJ1102
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RJ1102  HISTORY      - Date      Condition        Recov. By
RJ1102  HISTORY      - 1965      MONUMENTED       CGS
RJ1102
RJ1102                           STATION DESCRIPTION
RJ1102
RJ1102'DESCRIBED BY COAST AND GEODETIC SURVEY 1965 (LMC)
RJ1102'THE STATION IS LOCATED NEAR THE NORTHWEST CORNER OF A BRIDGE, WHERE
RJ1102'STATE HIGHWAY 48
RJ1102'CROSSES OVER INTERSTATE HIGHWAY 75, ABOUT 3-1/2 MILES
RJ1102'SOUTHEAST OF RUDYARD, 6-1/2 MILES
RJ1102'WEST-SOUTHWEST OF KINROSS, AND ON
RJ1102'STATE OWNED PROPERTY.
RJ1102'
RJ1102'TO REACH THE STATION FROM THE POST OFFICE IN RUDYARD, GO EAST ON
RJ1102'MAIN STREET FOR
RJ1102'0.4 MILE TO A CROSSROAD.  TURN RIGHT AND GO SOUTH ON
RJ1102'MACKINAC TRAIL AND STATE HIGHWAY
RJ1102'48 FOR 3 MILES TO A SIDE ROAD LEFT.
RJ1102'TURN LEFT AND GO EAST ON HIGHWAY 48 FOR 1.5 MILES
RJ1102'TO A CROSSROAD AND
RJ1102'THE AZIMUTH MARK ON THE RIGHT.  CONTINUE EAST ON HIGHWAY 48 FOR 0.45
RJ1102'MILE TO THE
RJ1102'STATION ON THE LEFT NEAR THE NORTHWEST CORNER OF THE BRIDGE.
RJ1102'
RJ1102'STATION MARKS ARE STANDARD DISKS STAMPED OVERPASS 1965.  THE
RJ1102'SURFACE DISK IS
RJ1102'SET IN A ROUND CONCRETE MONUMENT WHICH IS FLUSH WITH
RJ1102'WITH THE SURFACE OF THE GROUND.
RJ1102'IT IS 213 FEET WEST OF THE CENTER OF
RJ1102'THE SOUTH BOUND LANE OF INTERSTATE 75, 173 FEET
RJ1102'SOUTHWEST OF A FENCE
RJ1102'CORNER, 133 FEET SOUTH OF A WIRE FENCE, AND 91 FEET NORTHEAST OF
RJ1102'THE NORTHWEST
RJ1102'CORNER OF THE BRIDGE.  THE UNDERGROUND DISK IS SET IN AN
RJ1102'IRREGULAR MASS OF CONCRETE
RJ1102'44 INCHES BELOW THE SURFACE OF THE GROUND.
RJ1102'
RJ1102'REFERENCE MARK NO. 1, A STANDARD DISK STAMPED OVERPASS NO 1 1965,
RJ1102'CEMENTED IN A
RJ1102'DRILLED HOLE IN THE NORTH END OF THE 3RD CONCRETE FOOTING
RJ1102'EAST OF THE WEST END OF THE
RJ1102'BRIDGE.  THE FOOTING PROJECTS 30 INCHES.
RJ1102'
RJ1102'REFERENCE MARK NO. 2, A STANDARD DISK STAMPED OVERPASS NO 2 1965,
RJ1102'CEMENTED IN A
RJ1102'DRILLED HOLE IN THE NORTH END OF THE 1ST CONCRETE FOOTING
RJ1102'EAST OF THE WEST END OF THE
RJ1102'BRIDGE.  THE FOOTING PROJECTS 14 INCHES.
RJ1102'
RJ1102'AZIMUTH MARK, A STANDARD DISK STAMPED OVERPASS 1965, IS SET IN A
RJ1102'ROUND CONCRETE
RJ1102'MONUMENT WHICH PROJECTS 4 INCHES.  IT IS 57 FEET SOUTH
RJ1102'OF THE CENTER OF STATE HIGHWAY
RJ1102'48, 32 FEET WEST OF THE CENTER OF A
RJ1102'GRAVELED ROAD, 3 FEET NORTH OF A TELEPHONE POLE,
RJ1102'AND 2 FEET SOUTH OF A
RJ1102'METAL WITNESS POST.

*** retrieval complete.
Elapsed Time = 00:00:02
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The NGS Data Sheet

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DATABASE = Sybase ,PROGRAM = datasheet, VERSION = 5.21
       Retrieval Date = MAY  5, 1997          Version = 5.21
Starting Datasheet Retrieval...
1        National Geodetic Survey,   Retrieval Date = MAY  5, 1997
 RJ0241 **********************************************************************
 RJ0241  DESIGNATION -  T 44
 RJ0241  PID         -  RJ0241
 RJ0241  STATE/COUNTY-  MI/CHIPPEWA
 RJ0241  USGS QUAD   -  SULLIVAN CREEK (1978)
 RJ0241
 RJ0241                        *CURRENT SURVEY CONTROL
 RJ0241  ______________________________________________________________________
 RJ0241* NAD 83(1994)-  46 21 32.17537(N)    084 50 44.39915(W)      ADJUSTED
 RJ0241* NAVD 88     -       280.746  (meters)     921.08   (feet)  ADJUSTED
 RJ0241  ______________________________________________________________________
 RJ0241  X           -    396,162.391 (meters)                       COMP
 RJ0241  Y           -  -4,391,871.074 (meters)                      COMP
 RJ0241  Z           -   4,593,049.896 (meters)                      COMP
 RJ0241  LAPLACE CORR-          -5.88  (seconds)                     DEFLEC96
 RJ0241  ELLIP HEIGHT-         244.86  (meters)                      GPS OBS
 RJ0241  GEOID HEIGHT-         -35.89  (meters)                      GEOID96
 RJ0241  DYNAMIC HT  -         280.758 (meters)     921.12   (feet)  COMP
 RJ0241  MODELED GRAV-     980,650.3   (mgal)                        NAVD 88
 RJ0241
 RJ0241  HORZ ORDER  -  FIRST
 RJ0241  VERT ORDER  -  FIRST     CLASS II
 RJ0241  ELLP ORDER  -  FOURTH    CLASS I
 RJ0241
 RJ0241
 RJ0241
 RJ0241.The horizontal coordinates were established by GPS observations
 RJ0241.and adjusted by the National Geodetic Survey in February 1997.
 RJ0241
 RJ0241.The orthometric height was determined by differential leveling
 RJ0241.and adjusted by the National Geodetic Survey in June 1991.
 RJ0241
 RJ0241.The X, Y, and Z were computed from the position and the ellipsoidal ht.
 RJ0241
 RJ0241.The Laplace correction was computed from DEFLEC96 derived deflections.
 RJ0241
 RJ0241.The ellipsoidal height was determined by GPS observations
 RJ0241.and is referenced to NAD 83.
 RJ0241
 RJ0241.The geoid height was determined by GEOID96.
 RJ0241
 RJ0241.The dynamic height is computed by dividing the NAVD 88
 RJ0241.geopotential number by the normal gravity value computed on the
 RJ0241.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
 RJ0241.degrees latitude (G = 980.6199 gals.).
 RJ0241
 RJ0241.The modeled gravity was interpolated from observed gravity values.
 RJ0241
 RJ0241;                    North         East      Units   Scale      Converg.
 RJ0241;SPC MI N     -   177,371.816 8,165,763.023   MT  0.99990366 +1 33 25.7
 RJ0241;UTM  16      - 5,136,184.510   665,731.283   MT  0.99993764 +1 33 33.8
 RJ0241
 RJ0241                          SUPERSEDED SURVEY CONTROL
 RJ0241
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RJ0241  NAD 83(1986)-  46 21 32.16828(N)     084 50 44.39628(W)      ADJUSTED
RJ0241  NGVD 29      -       280.702  (meters)     920.94   (feet)  ADJ UNCH
RJ0241
RJ0241.Superseded values are not recommended for survey control.
RJ0241.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
RJ0241.See file format.dat to determine how the superseded data were derived.
RJ0241
RJ0241_MARKER: DB = BENCH MARK DISK
RJ0241_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT (ROUND)
RJ0241_STAMPING: T 44 1934
RJ0241_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO
RJ0241+STABILITY: SURFACE MOTION
RJ0241_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
RJ0241+SATELLITE: SATELLITE OBSERVATIONS - May 01, 1991
RJ0241
RJ0241  HISTORY      - Date     Condition        Recov. By
RJ0241  HISTORY      - 1934     MONUMENTED       CGS
RJ0241  HISTORY      - 1935     GOOD             NGS
RJ0241  HISTORY      - 1988     GOOD             USE
RJ0241  HISTORY      - 19910501 GOOD             NOS
RJ0241
RJ0241                          STATION DESCRIPTION
RJ0241
RJ0241'DESCRIBED BY NATIONAL GEODETIC SURVEY 1935
RJ0241'5.9 MI E FROM STRONGS.
RJ0241'5.9 MILES EAST ALONG THE DULUTH, SOUTH SHORE AND ATLANTIC
RJ0241'RAILWAY FROM STRONGS, CHIPPEWA COUNTY, 5 FEET SOUTH OF MILEPOST
RJ0241'26, AND 20 FEET NORTH OF THE TRACK.  A STANDARD DISK, STAMPED
RJ0241'T 44 1934 AND SET IN THE TOP OF A CONCRETE POST.
RJ0241
RJ0241                          STATION RECOVERY (1988)
RJ0241
RJ0241'RECOVERY NOTE BY US ENGINEERS 1988 (RAB)
RJ0241'THE STATION IS LOCATED ABOUT 5.9 MILE EAST OF STRONGS MICHIGAN.
RJ0241'
RJ0241'TO REACH THE STATION FROM STRONGS MICHIGAN, GO EAST FOR 9.5 KM
RJ0241'(5.9 MI) ALONG M-28 TO STATION LOCATED 6 METERS (20 FEET) NORTH OF
RJ0241'ABANDONED RAILROAD GRADE WHICH IS ALONG NORTH SIDE OF HIGHWAY M-28.
RJ0241
RJ0241                          STATION RECOVERY (1991)
RJ0241
RJ0241'RECOVERY NOTE BY NATIONAL OCEAN SURVEY 1991
RJ0241'RECOVERED IN GOOD CONDITION.

*** retrieval complete.
Elapsed Time = 00:00:02
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